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NON-FERROUS METALS

NON-FERROUS metals constitute a group of strategically important raw materials essential not only for the production of munitions but also for the peacetime development and maintenance of the engineering, chemical and transport industries which have become so characteristic a feature of modern civilisation. The discovery of mineral fuels—coal and petroleum—led to an extensive utilisation of metals in the fabrication of machines for the production and transmission of motive power. The rise of electrical energy as one of the principal and convenient sources of power has been responsible for the phenomenal demand for copper in recent years. While the iron industry may be said to have grown with the steam engine, the copper industry has developed with the electric motor.

The progress of chemical industries is closely connected with the development of the non-ferrous metals and its alloys. Copper has been extensively used in the construction of chemical plant, particularly those classes of equipment, evaporators and condensers, where heat transmission plays an important role. Lead has been responsible for the rise and expansion of the acid and allied heavy chemical industries.

A wide choice of alloy steels and monel metals is now available to the chemical engineer. These materials of construction have enabled him to fabricate chemical plant and equipment, remarkable for their resistance to chemical corrosion; they have facilitated the production of chemicals sensitive to metallic contamination.

Food and canning industries owe their rise and prosperity to tin, which is also needed for the making of solders, gun metals, bronzes and other alloys. Zinc is needed for galvanising steel and for alloying in the production of brasses. High speed machine tools depend upon tungsten, vanadium, molybdenum and chromium. Some of the fundamental catalytic reactions in industry are brought about by platinum, vanadium and nickel. An unfailing demand for antimony is maintained by the printing

trade and the metal is also used for the manufacture of shrapnel bullets. An increasing use of silver in industry is also perceptible. So far reference has been made only to the heavy non-ferrous metals and their alloys.

The recognition of aircraft as a means of quicker transport and as a powerful weapon of war, had led to spectacular advances in the metallurgy of light metals—aluminium and magnesium and their numerous alloys. The chief merit of these metals and their alloys, lies in their remarkable lightness coupled with tensile strength, which has been capitalised in the production of aircraft. The perfection of the numerous types of airplanes and the airships, opened a new and ever-widening markets for these light metals. In addition the manufacture of aluminium paint, aluminium foil and collapsible tubes has further extended the employment of this metal. In America an entirely new use for these light alloys was found in the manufacture of structural shapes for building and construction. Unless lighter meterials are substituted in construction, the increased height of skyscrapers would involve a proportionately higher cost for excavation and foundation work. In Germany, aluminium is replacing copper for the manufacture of electrical transmission cables. In the field of fermentation technology, high grade aluminium is perhaps the only metal so far discovered, which has been found suitable for the fabrication of fermentation tanks, trays and other equipment. The employment of other metals in place of aluminium has been found to prove more or less toxic to the process of fermentation. In the fermentative production of citric acid, aluminium of 99·9 per cent. purity, has got to be used in the making of the fermentation trays, since otherwise the process will not result in an economic yield of the product.

Addressing the members of the Electrical Engineering Society, Indian Institute of Science, Bangalore, Professor J. C. Ghosh, the Director of the Institute, told the audience that the position of non-ferrous metals in the country was unsatisfactory if not alarming. The loss of Malaya and Burma has created a serious situation with respect to the supplies of tin, zinc and lead. India needs five thousand tons of electrolytic copper, the entire quantity of which is imported. The Indian Copper Corporation at Ghatshila produces about six thousand tons of copper, most of which is utilised for the manufacture of household utensils and brass. A small but promising beginning has been made in the production of antimony. About 12 tons of crude antimony per month are now being produced at Vikroti near Bombay from the sulphide ores mined at Chitral.

The occurrence of nickel in India had not been suspected but more recently the metal has been reported to exist in the snow-bound Himalayan regions near Nepal. It is curious that nickel should always be associated with snow-bound tracts.

Professor Ghosh revealed that an extensive deposit of copper ores, has recently been discovered in the State of Jaipur. The country is capable of meeting its entire and ever-growing requirements of the light metals and alloys but at the moment the actual production of the aluminium has not yet commenced in spite of several earnest attempts. Experiments on the production of magnesium have been taken up by the

Indian Institute of Science at the request of the Hindustan Aircraft authorities. Although new and rich deposits of minerals may be discovered in the country, it would be difficult, for sometime to come, to obtain the necessary machinery and equipment for winning the metal from its ores. Under these circumstances, Professor Ghosh suggested the adoption of strict economy and systematic recovery of metals from scraps and wastes. He instanced the case of Germany and Japan where the recovery of tin from waste tin plate scrap constituted a flourishing industry. As a war emergency he pleaded for the development of refineries throughout the country with a view to recover the metals from wastes. In this connection, attention may be invited to an informative article on the disposal of scrap of important non-ferrous metals by Dr. Mitter which has just appeared in the October number of *Science and Culture*.

But the country needs a long-range plan with regard to these non-ferrous metals. The creation of the Utilisation Branch of the Geological Survey of India will be heartily welcomed. It is possible that the combined activities of these technical bodies will lead to the country's self-sufficiency with regard to these metals. The demand for these non-ferrous metals will become more and more pressing as the tempo of the country's industrial advance increases. The Aircraft and Shipbuilding Industries have been inaugurated in the country; there has been a spectacular rise in the development of chemical, electrical and engineering industries; the armament industry, initiated as an emergency step, will come to stay in a post-war India, as a measure of defence. All these industries would need more and more of non-ferrous metals and their alloys. In view of the industrial and strategic importance of these metals, the creation of a Central Institute of Metallurgical Research for non-ferrous metals would be more than justified; this is a matter which deserves the earnest attention of the Board of Scientific and Industrial Research and the Government of India.

BERYLLIUM COPPER ALLOYS

THE discovery of the alloying properties of beryllium is one of the outstanding achievements of metallurgical science and may be compared from the metallurgical, if not from the economic point of view, with the age-old observation of the effect of carbon on iron.

Beryllium transforms copper or nickel alloys with hardnesses comparable with that of steel. Previously it had not been possible to harden copper to any extent and certainly not to any degree which would permit a good cutting edge or a hard wearing surface to be obtained.

This advancement is achieved by the addition of only 2 per cent. of beryllium. Not only does beryllium confer hardness on copper or nickel but it increases their resistance to "fatigue", in fact, Be-Cu will stand up to reversing operations such as are met with in the operations of springs or flexible diaphragms for a longer time than any other known non-ferrous alloy.

The difficulty of extracting Be from beryl has been overcome for commercial purposes by reducing the metal into a matrix of Cu or Ni, giving a "master" alloy with comparatively low Be content at an economic price, which can be satisfactorily utilised for making up the finished alloys. Non-sparking hand tools, and non-magnetic Be-Cu alloys can be made soft or hard at will by a simple heat treatment.

HETERAKIS TRAGOPANIS, A NEW SPECIES OF THE GENUS HETERAKIS FROM THE INTESTINE OF A CRIMSON-HORNED PHEASANT

BY

M. B. LAL

(*Department of Zoology, Lucknow University*)

A LARGE number of these parasites were recovered[1] from the intestine of a crimson-horned pheasant, *Tragopan satyra* which died at the Prince of Wales Zoological Gardens in Lucknow.

Male.—Length about 8·0 mm.; maximum breadth 0·3 mm.; feeble lateral alæ present. Caudal alæ broad and well developed and tend to unite across the ventral surface, a little anterior to the pre-cloacal sucker. Pharynx and œsophagus including the bulb measure 1·05 mm. Œsophageal bulb is 0·25 mm. long and 0·2 mm. broad. Tail of the male is 0·51 mm. long. Pre-cloacal sucker lies at a distance of 0·16 mm. from cloacal aperture. The sucker is thickly chitinised around its margin. The chitin is specially thickened at the middle of the anterior and posterior border of the sucker and appears to project out like two teeth perpendicular to the margin of the sucker. The sucker measures 0·07 mm. × 0·04 mm. in cross axes. There are eleven paired caudal papillæ and one single median papilla. There are two pairs of long peduncled papillæ lying by the lateral sides of the pre-cloacal sucker besides a median short peduncled papilla which lies on the posterior border of the sucker. There are six pairs of papillæ around the cloacal aperture;

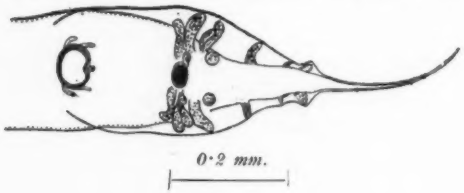

FIG. 1

Heterakis tragopanis (male), posterior end—ventral view showing arrangement of papillæ

four pairs of these have extremely long peduncles and extend into the alar projections. The remaining two pairs are small; the one by the side of the cloacal aperture has a short peduncle and the other situated a little posterior to it appears to be sessile and is rounded in shape. Posterior to these papillæ and post-cloacol in position lie three pairs of peduncled papillæ. These project into the alar membrane; the one proximal to the cloacal group of papillæ is larger than the two distal ones. The spicules are almost equal in size, the right one measures 1·6 mm. and the left which is slightly smaller than the right measures 1·5 mm.

Female.—Length about 10·00 mm. Maximum breadth in the region of vagina 0·4 mm. Pharynx and œsophagus including bulb

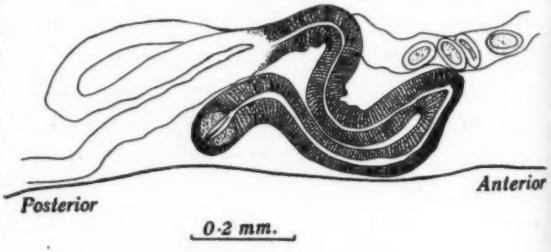

FIG. 2

Heterakis tragopanis (female), Vagina – latero-ventral view

measures 1·1 mm. of which the bulb occupies a length of 0·28 mm. Basal width of the bulb is 0·15 mm. The tail of the female is tapering into a long filament and measures 0·9 mm. The vulva which is protected by a pair of lips is situated in the pre-equatorial region of the body—4·8 mm. from the anterior end and 5·2 mm. from the posterior end. The vagina which is thickly muscular and capable of great expansion is 1·3 mm. long and runs cephalad from the vulva for half its length. It then bends caudad and after running for a short distance again bends cephalad but immediately

makes a sharp turn caudad where it divides into two uterine tubes. One of these after running caudad beyond the anal opening bends cephalad and runs anteriorly, the other shortly after divergence turns on itself and runs cephalad dorsal to the vagina. The eggs are oval and thick-shelled. They measure 0·075 mm. × 0·04 mm. in cross axes.

Discussion.—A large number of species[2] of the genus *Heterakis* have been described from different hosts in various parts of the world. The distinction between these species has been based apparently upon the number and arrangement of caudal papillæ, nature and size of spicules, size and position of pre-cloacal sucker, position of vulvar opening and size of eggs. Maplestone (1932)[3] is of opinion that none of these characters except the shape and, within wide limits, the size of spicules are constant enough to discriminate between the various species. He thinks that the other characters mentioned above are subject to very great variation and hence are not reliable for taxonomic purpose. He lays special emphasis on the shape of the tip of the shorter spicule. To me, however, this character appears to be extremely variable. Even Maplestone does not seem to be very clear on this point as in his own paper referred to here the following two statements need comment:—

On page 416, Maplestone says, "The only male characters which appear to be reliable for specific distinction are shape and within wide limits, the size of the spicules. This applies specially to the shorter spicule in all the species studied, for in practically every instance the tip has a characteristic barb or curve which only *varies slightly* within the species."

On page 405, Maplestone says, "Lane (1917)[4] in his description of the worm, under the name *H. vesicularis*, drew attention to the characteristic double curve at the end of the short spicule. This curve is only visible when the spicule is seen from the side, and I have found the degree and abruptness of the curve to *vary considerably* in different individuals."

The second objection in accepting Maplestone's view is the apparent difficulty in distinguishing between *H. gallinæ* and *H. variabilis*,[5] both of which are valid species according to Maplestone. In both cases the shorter spicule shows a more or less double curve at the tip and the size of the spicules in the two species also is more or less covered up uniformly by the measurements given. It may, therefore, be more desirable to consider all the characters together and not the character of spicule alone in distinguishing between the various species of the genus.

In view of these observations it may be said that the present form differs widely from most of the hitherto known species but comes nearest to *H. gallinæ*, *H. bosia* and *H. isolonche*. From all these species, however, it differs in the number, shape and arrangement of the caudal papillæ, relative sizes of the spicules, the size of the pre-cloacal sucker, and the course of vagina. It differs further from *H. gallinæ* and *H. bosia* in having a pre-equatorial vulvar opening and from *H. isolonche* in the position of the pre-cloacal sucker. It is, therefore, described as a new species.

[1] I am thankful to Dr. G. S. Thapar who kindly offered me his collection of Nematodes for the purpose of the present study and made useful suggestions during the progress of this work. My grateful acknowledgements are also due to Prof. H. G. D. Mathur for the loan of some Journals from his library.

[2] See Cram. E. B., "Bird parasites of the Nematode suborders Strongylata, Ascaridata and Spirurata," *Bull. U.S. Nat. Mus.*, **1927**, 140.

[3] Maplestone, P. A., "The genera *Heterakis* and *Pseudaspidodera* in Indian hosts," *Ind. Journ. Med. Res.*, **1932**, **20**.

[4] Lane C., "Suckered roundworms from India and Ceylon," *Ibid.*, **1914**, **2**.

[5] Baylis, H. A., has since mentioned *H. variabilis* as a synonym of *H. isolonche*. (Vide *The Fauna of British India, Nematoda*, **1936**, **1**.)

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THE EQUATIONS OF FIT IN GENERAL RELATIVITY

For an isolated mass of fluid having the boundary

$$f(x^\mu) = 0 \qquad (1)$$

the internal field is given by $g_{\mu\nu}$ satisfying the equations,

$$G_{\mu\nu} - \tfrac{1}{2} G g_{\mu\nu} = -KT_{\mu\nu} \equiv -k(p+\rho)\, v_\mu v_\nu + kp g_{\mu\nu}, \qquad (2)$$

and the external field by $g'_{\mu\nu}$ which are subject to

$$G_{\mu\nu} = 0. \qquad (3)$$

The equations of fit are usually stated as

$$g_{\mu\nu} = g'_{\mu\nu},\ p = 0. \qquad (4)$$

These boundary conditions are not usually sufficient. Consider, as an example, the external field,

$$ds^2 = -(1+m/2r)^4 (dr^2 + r^2 d\theta^2 + r^2 \sin^2\theta d\phi^2) + \left(\frac{1-m/2r}{1+m/2r}\right)^2 dt^2 \qquad (5)$$

for $r \geqslant a$ and the internal field, for $r \leqslant a$,

$$ds^2 = -e^\mu (dr^2 + r^2 d\theta^2 + r^2 \sin^2\theta d\phi^2) + e^\nu dt^2, \qquad (6)$$

μ and ν are functions of r and when the differential equations for them are solved four arbitrary constants appear in them. The equations of fit (4) provide only three conditions. We find now that there is a fourth condition, *viz.*,

$$\left[e^{\mu/2} r^2 \frac{\partial}{\partial r}(e^{\nu/2})\right]_{r=a} = m, \qquad (7)$$

which has got to be satisfied if the distribution given by (6) is to behave like a particle of mass m at great distances. Using (4) and (7) we get

$$e^\mu = \frac{(1+m/2a)^6}{(1+mr^2/2a^3)^2},$$

$$e^\nu = \left(\frac{2-m/2a}{1+m/2a} - \frac{1}{1+mr^2/2a^3}\right)^2, \qquad (8)$$

$$8\pi\rho = \frac{6m/a^3}{(1+m/2a)^6},$$

$$8\pi p = \frac{(3m^2/a^4)(1-r^2/a^2)}{(1+m/2a)^6 (1-m/2a+mr^2/a^3 - m^2r^2/4a^4)}. \qquad (9)$$

G. K. Patwardhan and P. C. Vaidya have shown in a paper, which is awaiting publication, how (7) arises from the principles of conservation. It is implicit in Tolman's[2] exposition

of these principles that the continuity of

$$-g^{\alpha 4}\sqrt{-g}\,A^{\gamma}_{\mu\alpha} + \tfrac{1}{2}\,g^{4}_{\mu}\,g^{\alpha\beta}\,\sqrt{-g}\,A^{\gamma}_{\alpha\beta}\quad \mu=1,2,3,4;\ \gamma=1,2,3 \quad (10)$$

"On the boundary is necessary. Here

$$A^{\gamma}_{\alpha\beta} = -\Gamma^{\gamma}_{\alpha\beta} + \tfrac{1}{2}\,g^{\gamma}_{\alpha}\,\Gamma^{\rho}_{\beta\rho} + \tfrac{1}{2}\,g^{\gamma}_{\beta}\,\Gamma^{\rho}_{\alpha\rho} \quad (11)$$

This continuity ensures the conservation of energy and momentum provided

$$\frac{\partial}{\partial x^4}\iiint\Big(-g^{\alpha 4}\sqrt{-g}\,A^{4}_{\mu\alpha} + \tfrac{1}{2}\,g^{4}_{\mu}\,g^{\alpha\beta}\sqrt{-g}\,A^{4}_{\alpha\beta}\Big)\,dx^1\,dx^2\,dx^3 = 0, \quad (12)$$

the integral being taken over the whole space for $\mu = 1, 2, 3, 4$.

It is believed that the results (7), (8) and (9) are new. We are publishing elsewhere the full implications of Tolman's tacit assumption regarding the continuity of (12) which leads to (7). He seems to be unaware of (7).[3]

Lastly, another new point that has struck us in this connection may be noted. For the geodesies on the boundary surface we have

$$g_{\mu\nu}\frac{dx^{\mu}}{ds}\,\frac{dx^{\nu}}{ds} = \pm 1, 0, \quad (13)$$

$$f_{\mu}\frac{dx^{\mu}}{ds} = 0, \quad (14)$$

$$\Big(-\frac{\partial f}{\partial x^{\mu}}\,\Gamma^{\mu}_{\alpha\beta} + \frac{\partial^2 f}{\partial x^{\alpha}\partial x^{\beta}}\Big)\,\frac{dx^{\alpha}}{ds}\,\frac{dx^{\beta}}{ds} = 0 \quad (15)$$

along with (1). If there is to be no ambiguity about these geodesies (15) must be the same whether it is couched in terms of $g_{\mu\nu}$ or $g'_{\mu\nu}$. That this is true has been verified for spherical distributions.

V. V. NARLIKAR.
P. C. VAIDYA.

Benares Hindu University,
September 12, 1942.

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[1] Eddington, Sir A. S., *The Mathematical Theory of Relativity*, 1924, 93.

[2] Tolman, R. C., *Relativity, Thermodynamics and Cosmology*, 1934, 232.

[3] —, *Phys. Rev.*, 1939, **55**, 364.

ON A LACUNA IN THE TREATMENT OF INTERNAL SOLUTIONS IN GENERAL RELATIVITY

WE give here an example to show how the usual treatment of internal solutions is inadequate and sometimes even wrong. Consider a line-element,

$$ds^2 = -e^{\mu}\,(dr^2 + r^2\,d\theta^2 + r^2\sin^2\theta\,d\phi^2) + e^{\nu}dt^2, \quad (1)$$

which satisfies the internal field equations for $r \leqslant a$ and is continuous with the isotropic line-element of the external field for a mass m. A new solution of the equations is given by

$$e^{\mu} = \Big(1+\frac{m}{2a}\Big)^4\,\Big(\frac{r}{a}\Big)^{\lambda}, \quad (2)$$

$$e^{\nu/2} = \frac{1-\frac{m}{2a}}{1+\frac{m}{2a}}\,\frac{1}{2d}\,\Big(\frac{r}{a}\Big)^{1+\frac{\lambda}{2}-n}\Big[(c+d) - (c-d)\Big(\frac{r}{a}\Big)^{2n}\Big], \quad (3)$$

$$8\pi\rho = \frac{a^{\lambda}}{\Big(1+\frac{m}{2a}\Big)^4}\,r^{-\lambda-}\Big(\lambda+\frac{1}{4}\lambda^2\Big), \quad (4)$$

$$8\pi p = \frac{a^{\lambda}\,(c^2-d^2)}{\Big(1+\frac{m}{2a}\Big)^4}\,r^{-\lambda-2}\Big[\frac{a^{2n}-r^{2n}}{(c+d)\,a^{2n}-(c-d)\,r^{2n}}\Big], \quad (5)$$

where $c = 2+3\lambda+3\lambda^2/4$, $d = n\,(\lambda+2)$,
$n = (1+2\lambda+\lambda^2/2)^{1/2}$

For the pressure and density to be non-negative it is necessary that

$$0 \geqslant \lambda \geqslant -2+\sqrt{2} \quad (6)$$

when n is real. For imaginary values of n the solution can be similarly discussed. We take up now the question whether the distribution so obtained behaves like a particle of mass m at infinity. In the customary treatment this question is not examined and solutions like the one given above are understood as correct. Having discussed the equations of fit at $r = a$ we find that an additional condition, *viz.*,

$$\frac{m}{a} = -\frac{2\lambda}{\lambda+4} \quad (7)$$

has to be satisfied if the internal distribution is to have the same field at infinity as a particle of mass m. The equations of fit have been considered by two of us (V. V. N. and P. C. V.) in another communication to *Current Science*. The above solution is valid only if (7) is fulfilled.

P. C. VAIDYA.
V. V. NARLIKAR.
G. K. PATWARDHAN.

Benares Hindu University,
September 25, 1942.

SUNRISE MAXIMA IN THE INTENSITY OF DISTANT ATMOSPHERICS RECEIVED IN MEDIUM FREQUENCY CHANNELS

ANOMALIES in the intensity value of distant atmospherics during the sunrise and sunset periods were known for a long time. Eccles[1] observed a minimum during the sunset time and this was confirmed by other investigators. Potter's[2] work on atmospherics on a range from 5 Mc/s to 20 Mc/s indicated intensity maxima both during the sunrise and sunset periods. Double peaks were also observed by him during the sunrise period on some occasions. The recent investigations in this laboratory[3] on distant atmospherics, on a range from 2 Mc/s to 20 Mc/s, revealed intensity maxima in the early morning, some minutes before the ground sunrise and also in the late evening, some minutes after the ground sunset. Usually one maximum (and occasionally two maxima) was observed before the ground sunrise and one maximum after the ground sunset. An unmistakable maximum was also observed[4] on medium frequency during the sunset period.

The object of the present communication is to present the results of some experiments on 800 Kc/s carried out in early morning, well covering the ground sunrise period. The interpretation of the results and some conclusions therefrom are also given.

The peak method of measurement was employed in the work. A three valve receiver consisting of a H.F. amplifier, a detecting valve and a L.F. amplifier, was worked with a suitable frame aerial. The plane of the frame was directed towards the East-West direction and also towards North-South direction. The receiver was carefully calibrated and the field-strength of the atmospherics was estimated from the observed deflection in the balanced galvanometer placed in the anode circuit of the last valve in the receiver. Two typical sets of experimental results on 800 Kc/s are shown in Fig. 1. It should be observed that the intensity variation of the atmospherics about the sunrise time could be of either type A or B in the figure. Usually the fieldstrength was found to diminish rapidly and steadily as in type A long before the ground sunrise when the fieldstrength began to show an increase. In some observations, however, two distinct

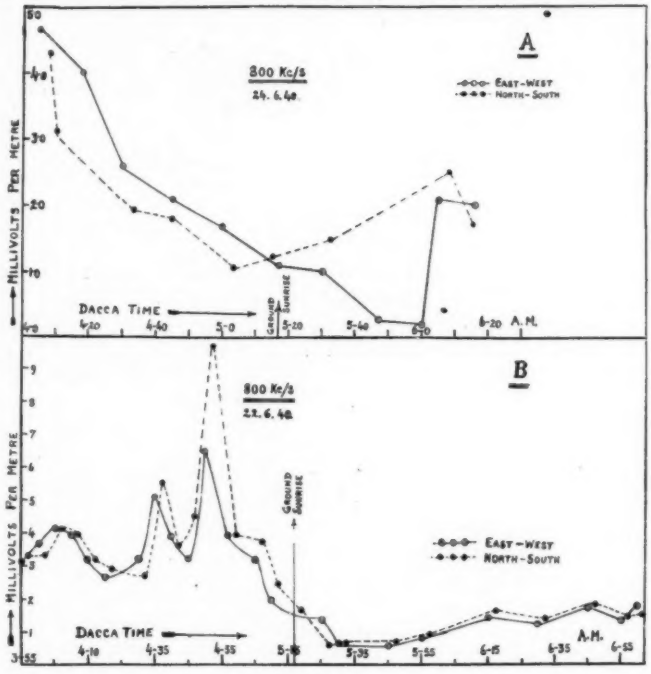

FIG. 1

maxima were observed, as in type B, one after another, both before the ground sunrise. These maxima were followed by a rapid decrease in intensity, continuing for sometime even after the ground sunrise. If the observations are not made at very short intervals, there is liklihood that these maxima would be masked by the extremely rapid fall in the fieldstrength of the atmospherics. The A-type of intensity variation is therefore observed more frequently.

In a recent note by one of us,[5] the intensity maxima of the distant atmospherics observed

before the ground sunrise and after the ground sunset have been explained. The early morning maximum has been associated with the ionization minimum in the E-layer observed in the small hours of the morning. Before the ionization minimum, it is evident, there is a gradual decrease in electron density in the layer. The collision frequency in the layer and hence the attenuation, diminishes gradually causing a gradual fall in the intensity of the downcoming waves, till there is a maximum when the E-layer ionization is minimum. After this minimum, the ionization *rapidly* increases during the sunrise period. This causes a large fall in the intensity of the downcoming waves owing to:—(1) higher attenuation due to larger collision frequency in the layer, and (2) larger deviation of the rays due to higher electron density. An early morning maximum is thus explained. The work of Mitra and his students[6] on the early morning increase of the E-layer ionization has, however, shown that the ionization begins to increase only when the solar rays strike the layer by grazing the top of the Ozonosphere which is at a height of 35 Km. from the earth's surface. In order to produce ionization in the layer, the solar rays must pass over the ozone region or else the shorter wavelength constituents of the sun's rays which cause ionization would be absorbed by the ozone.

If we denote the angular distance between the source of atmospherics and the receiving point (both being supposed on the surface of the earth in the East-West plane) by θ and the angle contained between the two tangents on either side of the Ozonosphere drawn from the point where the ionospheric reflection takes place be given by $(180°-2\phi)$, it can be shown that the instant when the solar rays would begin to produce ionization in the layer would be earlier or later than the ground sunrise at the receiving point according as $\phi >$ or $< \theta/_2$. It can also be shown that the difference between the instant of ground sunrise at the receiving point and the instant when the ionization begins to increase in the region, where the ionospheric reflection takes place, would be given by

$$t = 4(\phi \mp 2\theta) \text{ minutes.}$$

The upper difference sign is to be used, when the receiving point is to the east of the source of atmospherics and the lower positive sign when the receiving point is to the west. Thus when $\phi > \theta/_2$, the sunrise maximum is expected $(4\phi \mp 2\theta)$ minutes before the ground sunrise at the receiving point. When however $\phi < \theta/_2$, i.e., when the source of atmospherics is *very* distant, the sunrise maximum should appear $(2\theta \mp 4\phi)$ minutes after the ground sunrise.

With the higher frequency components there would be penetration of the E-layer and reflection would take place from the F-layer. Following similar arguments we would expect another intensity maximum at $(4\phi' \mp 2\theta)$ minutes before or after the ground sunrise according as $\phi' >$ or $< \theta/_2$, where ϕ' for the F-layer corresponds to the angle ϕ in the case of the E-layer. The time interval between the two maxima associated with the E- and the F-layers respectively would then be given by $\Delta t = 4(\phi' - \phi)$ minutes. Taking the E-layer reflection height to be 80 Km. and the F-layer reflection height (for 800 Kc/s) to be 150 Km., we get $\phi = 6°\cdot9$ and $\phi' = 10°\cdot8$, so that $\Delta t = 16$ minutes. In the particular set of observations (type B) for the East-West direction shown in Fig. 1, the two maxima appeared 42 minutes and 27 minutes respectively before the ground sunrise. The time interval between the two observed maxima was therefore 15 minutes. The agreement is thus extremely satisfactory.

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R. G. BASAK.

Physics Laboratory,
Dacca University,
September 21, 1942.

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[1] Eccles, *Handbook of Wireless Telegraphy and Telephony*, 1918, p. 176.

[2] Potter, *Proc. I.R.E.*, 1931, Oct. 19, 1731.

[3] Khastgir and Innas Ali, Communicated to *Ind. Jour. of Physics*.

[4] Khastgir and Rao, *Proc. I.R.E.*, 1940, Nov. 28, 511. Khastgir and Ray, *Science and Culture*, 1940, June 5, 772.

[5] Khastgir, Communicated to *Science and Culture*.

[6] Mitra, *Science and Culture*, 1938, March 3, 496. Ghosh, *Ind. Jour. of Physics*, 1940, April 14, part 2 101.

THE SYNTHESIS OF VITAMIN C BY RICE MOTH LARVÆ (*CORCYRA CAPHALONICA* STAINT)

THE synthesis of vitamin C by certain lower forms of life, *e.g.*, *B. prodigiosus*,[1] marine algæ[2] and the orthopterous insect *Blatella germanica*[3] has been reported. In the present communication evidence is brought forward to show that rice moth larvæ can synthesise the vitamin.

The larvæ were grown (*a*) on whole wheat and (*b*) on a synthetic diet consisting of starch, wheat protein, ether extract of wheat, dried yeast and salt mixture. The larvæ were killed at various stages of growth, minced and extracted according to the method of Bessey and King[4] employing 8 per cent. trichloracetic acid. Vitamin C was estimated in the extract by the chemical method using the indophenol dye. The larvæ, though grown on diets practically devoid of vitamin C, were found to contain the vitamin in significant amounts, ranging from 0·07–0·12 mg. per g. of body weight (or 2·4–4·0 mg. per g. of dry weight). The validity of these results was confirmed by various chemical procedures which are summarised in the following table:—

Treatment of the trichloracetic acid extract of larvæ	% vitamin C remaining after treatment	Remarks
1. Nil	100	Reversible oxidation of vitamin C by Norit. Incomplete recovery probably due to partial adsorption of the vitamin by Norit.
2. Norit (Fox and Levy[5])	0	
3. Filtrate from (2) treated with H_2S. H_2S driven out by current of CO_2 ..	80	
4. Mercuric acetate (Emmerie and van Eckelen[6]) ..	100	Removal of interfering substances, *e.g.*, cystine and glutathione.
5. Oxidation at pH 5·3 by the specific enzyme from drumstic (Sreenivasan[7])	0	Complete oxidation of vitamin C by the enzyme.
a. Extract + enzyme (Incubated at 37°C. for ½ minutes)	100	
b. ,, (boiled) (Incubated at 37°C. for ½ minutes)	100	Inhibition of the enzyme by KCN.
c. ,, + KCN 10^{-3}M (Incubated at 37°C. for ½ minutes)		

These results indicate that the dye-reducing substance in the larvæ extract is vitamin C. On the inclusion of vitamin C in the synthetic diet the growth of the larvæ as well as their vitamin C content did not show any significant increase, indicating that the larvæ do not depend on an extraneous source of the vitamin for growth. This, together with the ease with which the larvæ can be grown on any solid diet, suggests a possibility of using them as experimental animals for the study of precursors of vitamin C. Experiments have been carried out in which various sugars were included in the basal diet at a 5 per cent. level, but so far no significant effect on the synthesis of vitamin C has been observed.

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KAMALA BHAGVAT.
Nutrition Research Laboratories,
Indian Research Fund Association,
Coonoor,
October 3, 1942.

[1] Buising and Peters, *Biochem. Ztchr.*, 1940, **304**, 134.
[2] Norris, Simeon and Williams, *Jour. Nutr.*, 1937, **13**, 425.
[3] Wollman, Giroud and Ratsimamanga, *C.R. Soc. Biol.*, 1937, **124**, 434.
[4] Bessey and King, *Jour. Biol. Chem.*, 1933, **103**, 687.
[5] Fox and Levy, *Biochem. Jour.*, 1936, **30**, 208.
[6] Emmerie and van Eckelen, *Ibid.*, 1934, **28**, 1153.
[7] Sreenivasan, *Ibid.*, 1936, **30**, 2077.

SYNTHESIS OF POSSIBLE LIPOPHILIC CHEMOTHERAPEUTICALS OF THE SULPHANILAMIDE GROUP

ALTHOUGH the compounds of the sulphanilamide group already evolved have provided medical science with one of the most potent weapons for the effective conquest of a number of intractable diseases of bacterial origin, there is still a long list of bacterial infections uninfluenced by the newer chemotherapeuticals; among the latter, leprosy and tuberculosis continue to constitute some of the major posers to chemotherapy. This justifies further exploratory work both on compounds closely related to

the effective substances already known and on their structural allies but with other substituents with the possibility of an extension of their range of therapeutic usefulness so as to include infections caused by the acid fast mycobacterium.

The place of long chain fatty acids, particularly those derived from the chaulmoogra and hydnocarpus oils, in the treatment of leprosy and tuberculosis has, at the present time, been established. Systematic study of the numerous acyl derivatives of the sulphonamides hitherto synthesised has disclosed a few members effective in combating experimental coccal infections in mice associated with a low order of toxicity[1]; some of them have also passed actual clinical trials[2] with some measure of success. However, with the sole exception of N^1-dodecanoyl sulphanilamide which is uncertainly reported on[3], none of the fatty acid derivatives of the sulphonamides appear to have been investigated as to their efficacy in tuberculosis or leprosy.

Increased oil and fat solubility associated with lipophilic properties may be expected to be conferred on the resulting compounds consequent to the introduction of fatty acid residues in the molecules of the sulphonamides. It is possible to conceive with some justification[3,4] of a deleterious action of such fatty acid derivatives on the "waxy" capsules of the ubiquitous tubercular and leprous bacilli resulting in a break down of their first line of defence and that the damaged or stripped bacilli may subsequently be rendered susceptible to the further action of the acyl derivatives themselves or the parent sulphonamides or whatever *active* products that may be developed *in vivo*. The present preliminary communication, wherein the nomenclature of Crossley, Northey and Hultquist[5] has been conveniently adopted, is an essay in this direction. Synthesis has, therefore, been effected of the 23 compounds, listed below, with their melting points. They do not seem to have been so far reported in literature.

(1) N^4-Cyclohexoyl sulphanilamide 238° C. (2) N^4-*n*, Caproyl, N^1-acetyl S.A.* 166°–69° d. C. (3) N^4-*n*, Caproyl, N^1-*n*, butyryl S.A. 164°–68° C. (4) N^4, N^1-Di (*n*, caproyl-) S.A. 164°–72° C. (5) N^4-*n*, Caproyl, N^1-*n*, heptoyl S.A. 148°-52° C. (6) N^4-*n*, Caproyl, N^1-cyclohexoyl S.A. 185°–87° C. (7) N^4-*n*, Caproyl, N^1-palmityl S.A. 123°–26° C. (8) N^4-*n*, Caproyl, N^1-stearyl S.A. 127°–30° C. (9) N^4, N^1-Di (*n*, butyryl-S.A. 217°–20° C. (10) N^4, N^1-Di (*n*, heptoyl-) S.A. 131°–34° C. (11) N^4-*n*, Butyryl sulphapyridine 206° C. (12) N^4-*n*, Caproyl sulphapyridine 197° C. (13) N^4-*n*, Heptoyl sulphapyridine 193° C. (14) N^4-*n*, Butyryl sulphathiazole 244°–46° d. C. (15) N^4-*n*, Caproyl sulphathiazole 198°–99° C. (16) N^4-*n*, Heptoyl sulphathiazole 202°–03° C. (17) N^4-Cyclohexoyl sulphathiazole 222°–23° d.C. (18) N^4-Palmityl sulphathiazole 140°–47° C. (19) N^4-Stearyl sulphathiazole 148°–50° C. (20) N^4-*n*, Butyryl sulphathiazoline 224–25° C. (21) N^4-*n*, Caproyl sulphathiazoline 181°–82° C. (22) N^4-*n*, Heptoyl sulphathiazoline 175°–76° C. (23) N^4-Cyclohexoyl sulphathiazoline 220° C.

S.A.* = Sulphonlamide.

The N^4-acyl sulphonamides (Nos. 1, 11-23) were prepared by condensation of the requisite acid chloride on the respective sulphonamides in the presence of pyridine. For the preparation of the N^4-N^1-disubstituted derivatives of sulphanilamide (Nos. 2, 3, 5-8), N^4-*n* caproyl sulphanamide—reported[6] to be as antistreptococcal as sulphanilamide itself but possessing much lower toxicity—constituted the starting material: the condensations with the desired acid chlorides were carried out in pyridine medium. The remaining N^4-N^1-disubstituted sulphanilamides (Nos. 4, 9, 10) resulted directly by the operation of slightly more than 2 mols. of the appropriate acid chloride on sulphanilamide itself in pyridine solution. The condensation products, obtained by dilution of the reaction mixture with excess of water, were severally purified through precipitation from their dilute NaOH solutions (decolourising carbon) by acidification. They were mostly recrystallised from alcohol when they separated out in colourless needles with the exception of Nos. 14 and 15, which were obtained as slightly pale plates or prismatic needles. The yields of the final products were, in all instances, good.

I am thankful to Col. S. S. Sokhey and Prof. R. C. Shah for their interest and to the

Lady Tata Memorial Trust for the award of a scholarship.

S. RAJAGOPALAN.

Haffkine Institute,
Bombay,
October 2, 1942.

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[2] Welebir and Barnes, *J.A.M.A.*, 1941 **117**, 2132.
Maxwell and Bazalis, *Ibid.*, 1941, **117**, 2238.
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[3] Crossley *et al.*, *loc. cit.*
Steinbach and Duca, *Proc. Soc. Exp. Biol. Med.*, 1940 **44**, 133.

[4] Bergmann and Haskelberg, *J.A.C.S.*, 1941, **63**, 2243.

[5] Crossley, Northey & Hultquist, *Ibid.*, 1938, **60**, 2217.

[6] Miller *et al.*, *loc. cit.*

CHLOROPHÆITE BEARING BASALTS FROM THE CUDDUPAH TRAPS (PRE-CAMBRIAN)

IN the course of a detailed examination of the basaltic lava flows associated with the rocks of the Cuddapah system (Pre-cambrian) in South India, the presence of chlorophæite has been noticed. Since all the occurrences of chlorophæite so far recorded in India are from the comparatively much younger basalts such as those of the Rajamahal series[1] (lower to middle Jurassic) and the Deccan traps[2] (early Tertiary), the present find of this mineral in rocks so old as the Pre-cambrian is of some interest.

Chlorophæite occurs in the top basaltic flows of both the Papugnee and the Cheyair divisions of the Cuddapah system. The Vempally basalt is composed of labradorite, augite and iron ores. Chlorophæite occurs as amœboid patches in the interstices, is bottle green in colour, and has a refractive index *higher* than canada balsam. It also occurs as pellets or spherules infilling cavities, and is then

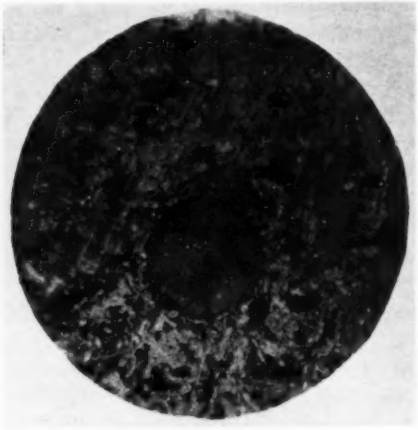

FIG. 1

Cuddupah Basalt, showing a large spherule of chlorophæite. Also shows irregular patches of chlorophæite in the groundmass.

bordered by spherulitic chalcedony. These spherules sometimes contain needles of epidote. The Banganapalli basalts show similar patches or spherules but the colour is yellow or brownish yellow, and has a refractive index *lower* than canada balsam. Chlorophæite is here accompanied by calcite.

The chlorophæite in these basalts has developed at the expense of the primary minerals as has already been observed in the case of the Deccan and the Rajamahal traps—felspar being the last mineral to be palagonitised, as microscopic fibres of chlorophæite are found surfeiting the felspars.

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Bangalore,
October 7, 1942.

[1] Middlemiss, "On some Palagonite bearing Traps of the Rajamahal Hills and Deccan," *Rec. G.S.I.*, **22**.

[2] Fermor, "On Basaltic Lavas of Bhusaval," *Ibid.*, **58**.
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PREPARATION OF 3-BROMO-SALICYLIC ACID

THE direct halogenation, for example direct bromination of salicylic acid gives 5-bromo-salicylic acid along with 3-5-dibromo-salicylic acid and 2-4-6-tribromo-phenol. 3-Bromo-salicylic acid has been therefore obtained indirectly. Lellmann and Grothman[1] have prepared it from 5-nitro-salicylic acid but in poor yields. More recently, Hirwe and collaborators[2] have developed methods to obtain 3-bromo-salicylic acid from (*a*) 5-sulpho-salicylic acid and (*b*) chloralsalicylamide; in both cases, the yields are sufficiently good. However both the methods involve practical operations which are not easy to manipulate.

We have now to report a method for the preparation of 3-bromo-salicylic acid in good yields, which involves mercuration and is fairly simple. Salicylic acid is mercurated with mercuric nitrate at the temperature of boiling water. The mercury-derivative thus obtained is treated with bromine in glacial acetic acid when 3-bromo-salicylic acid is obtained in 60 per cent. yield. If the mercuration of salicylic acid is effected with mercuric acetate, instead of mercuric nitrate, the yield of the 3-bromo-salicylic acid is 50 per cent.

The compound is crystallised from alcohol in the form of needles; m.p. is 183°. The analysis for bromine are:—

Found Br 37·1 per cent.

Calculated for $C_7H_5O_3Br$, Br 36·86 per cent.

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A. N. KOTHARE.
V. V. NADKARNY.

St. Xavier's College,
Bombay,
August 31, 1942.

[1] Lellmann and Grothman, *Ber.*, 1884, **17**, 2725.
[2] Hirwe and collaborators, *Pro. Ind. Acad. Sci.*, 1937, **5**, 321–25.

ON THE OCCURRENCE OF SCLEREIDS IN THE LEAF OF *OLEA DIOICA*

THE occurrence of Sclereids or stone cells within the leaf-tissue has been recorded in many plants, particularly in some of the members of Oleaceæ and Ternstrœmiaceæ. The sclereid cells are scattered within the mesophyll tissue and according to Stevens (1924) they give hardness and toughness without being an impediment to increase in size. In the present note a short account of the morphology, and development of the scleroids, within the leaves of *Olea dioica* is given.

In mature leaves the sclereid cells traverse the mesophyll tissue (Fig. 1) connecting the upper and lower epidermis. They are flattened and anchor-shaped at either ends. In some cases the cells develop branches which anastomose and form a reticulum. Similar instances of elongated stone cells traversing the mesophyll tissue have been recorded by Vesque and Pirotta (Boddle and Fritsch, 1908) in *Olea americana, O. angustifolia, O. chrysophylla, O. europea, O. undulata* and in species of *Linociera* and *Noronhia*.

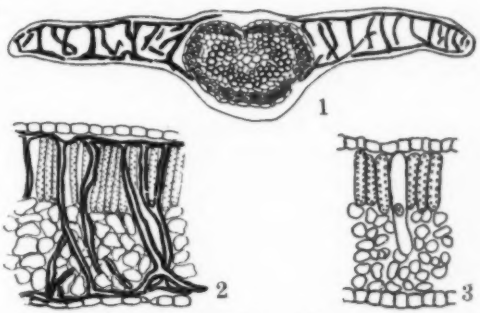

FIG. 1 Showing the sclereids within the leaf.
FIG. 2 Enlarged view showing the lumen within the sclereids.
FIG. 3 Palisade cell developing into the stone cell.

The developmental stages of the sclereid cells were traced in sections of the young leaves. The sclereid cell is the transformed palisade cell (Fig. 3). The palisade cell elongates in size becoming long and possessing a sinuous contour. The nucleus becomes slightly enlarged and migrates downwards. The cells are hayline owing to the absence of chloroplast. In the process of elongation the spongy cells are pushed aside. As development proceeds the elongated palisade cell forms short branches. The wall becomes thickened to a great extent and lignified leaving a

narrow lumen within the cell (Fig. 2). The nucleus degenerates and the degenerated mass persists even in late stages.

The sclerosed cells of the palisade tissue in *Linociera intermedia* Wight (Boodle & Fritsch, 1908) might also have a similar origin.

B. L. KRISHNASWAMY.

Bangalore,
September 9, 1942.

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WEIRS IN SOUTH INDIA AND THEIR EFFECT ON THE BIONOMICS OF THE HILSA IN THE SOUTH INDIAN RIVERS—THE GODAVARI, THE KISTNA AND THE CAUVERY*

PRIOR to the construction of these weirs, before the nineteenth century, one should presume that the spawning Hilsa had the whole run of the rivers excepting the upper reaches, and the eggs deposited in the freshwater sections found their way unobstructed downstream and the parent fishes also returned to the sea after spawning. The reduction of the spawning areas is, therefore, comparatively recent but none the less disastrous to the Hilsa fisheries in South India.

The distance between the first weir[1] and the sea in the rivers Godavari, Kistna and Cauvery, are respectively 60, 60 and 50 miles only. At present, it is in these short river-lengths that the parent fishes should spawn and the young larvæ reared. What with such a much diminished area for spawning and with the over-fishing caused by the fishermen taking advantage of the unsuspecting Hilsa in roe congregating below the first anicut, the survival of the Hilsa even in small numbers in South Indian rivers is a matter for legitimate surprise. What then is the remedy?

"Fish-passes" suggest themselves, but to be effective they presuppose two conditions:—

1. The fish whose protection is sought should have the habit of leaping in the air or swimming up-hill.

2. There should be the habit of spawning in the upper reaches only; when a fish can spawn in sections of the river in the plains, it cannot possess the urge to go uphill; the Hilsa do not seek the upper reaches and as a matter of fact they spawn even close to river-mouths. When the above two conditions do not exist, there is no case for fish-passes.[2]

The success of the Madras Government's efforts with Hatcheries has yet to be estimated. But the stocking of Hilsa-larvæ in short river-lengths does not forebode much success. The eggs generally want running flood-water for development and hatching and possibly the larvæ also need a period of sojourn in fresh-water. The short river-lengths which alone are now available for the spawners may not afford the time and distance necessary for the hatching and rearing of the larvæ before they could enter the estuaries and thrive there. If the larvæ enter the estuarine portion sooner than they should under natural conditions, a brackish-water environment may be lethal to them. The work of the hatcheries, therefore, may be a waste and no adequate return can be expected. Then again the uncertainty of procuring spawners during the spawning season is another handicap to hatcheries. Unless one is assured of a reasonable number of spawners, at a given place, in a given time, a hatchery cannot be worked with success. The experience of the Madras Fisheries Department has shown that the chances of obtaining spawners were very fitful and that the hatchery could not be worked annually.

Further, as South Indian Rivers contain little or no water for six months in a year, fish-passes constructed will then remain idle and money will have to be spent in watching them and keeping them in good condition. It occurs to me, therefore, that wise legislation such as prohibiting fishing within a five-mile (?) length of the river from the first weir, observing a closed season of a few weeks or restricting fishing below the first weir to three days

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in a week may produce a salutary effect on the Hilsa-fisheries, as this will check over-fishing and give the spawners intervals to spawn unmolested by man and to add to the stock of the existing population of the Hilsa.

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Madras,
July 14, 1942.

[1] I have called the weir nearest to the estuary 'the first weir'.

[2] *Vide* page 355, "Dams and Fisheries: Mettur and Its Lessons for India" by Dr. B Sundara Raj where the American Shad, a fish related to the Hilsa, is reported to have taken kindly to two Fish-passes with considerable width.

A NOTE ON THE USE OF POTASSIUM CHROMATE AS THE DELEADING AGENT IN THE DETEMINATION OF CLERGET'S SUCROSE IN SUGAR PRODUCTS

THE determination of sucrose by the double polarisation method involves leading a sugar solution and deleading the same with indicator. The absence of any such control in the case of the other deleading agents is well known.

By comparing the sugar added with the sugar recovered from waste molasses and distillery vinasses as recommended by E. Saillard, we found (1) that the sugar recovered from these two sources closely agreed with the sugar added only when the chromate acid and the chromate yeast methods were employed while with all other methods there was much divergence, (2) that the complications introduced by leading a sugar solution, namely, precipitation of glucose and fructose can be exactly balanced by deleading with potassium chromate, (3) that the effect of amides and amino-acids was eliminated and (4) that the values obtained very closely agreed with the yeast inversion methods.

The above are the typical results.

This shows that the chromate acid inversion method is a correct method, that the results agree with the yeast inversion method and this new method is a distinct advance over existing methods. Full details will be reported elsewhere.

Methods of Analysis	Molasses			Distillery vinasses					
				Vinasses only			Further complicated by Amides and Aminoacids		
	Sugar Added	Sugar Recovered	Deviation	Sugar Added	Sugar Recovered	Deviation	Sugar Added	Sugar Recovered	Deviation
1. Jackson and Gills method	15·24	17·03	1·79	15·26	16·78	1·52	15·26	17·71	2·45
2. Chromate acid	15·24	15·11	—0·11	15·26	15·35	0·09	15·26	15·32	0·06
3. do. Yeast ..	15·24	15·11	—0·11	15·26	15·36	0·10	15·26	15·32	0·06
4. Carbonate acid	15·24	12·56	—2·68	15·26	14·06	—1·20	15·26	16·74	1·48
5. do. Yeast ..	15·24	13·58	—1·66	15·26	15·35	0·09	15·26	15·48	0·22
6. Oxalate acid	15·24	12·56	—2·68	15·26	13·59	—1·67	15·26	14·21	—1·05
7. Phosphate acid	15·24	17·04	1·80	15·26	18·07	3·81	15·26	16·92	1·66

(*a*) sodium phosphate, (*b*) anhydrous potassium oxalate and (*c*) anhydrous sodium carbonate. We have re-investigated this method for sucrose by employing potassium chromate as a deleading agent, considering the possibility of an exact control of the added chromate with the help of silver nitrate as an external

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August 3, 1942.

THE FAT FROM THE SEEDS OF *VANGUERIA SPINOSA* (N.O. RUBIACEÆ)

THE seeds for the investigation were collected from a forest about 30 miles south-west of Kolhapur. The fruit (Mar.: *Alu;* Hindi: *Muduna, Moina*) is globose, smooth and yellowish brown when ripe, and is edible. The seeds are longish and biconvex.

The decorticated seeds were extracted with benzene, in a soxhlet, and the yield was calculated on this basis. The last traces of the solvent were removed by distillation under vacuum, whereupon the fatty oil set to a pale green solid mass.

The physical and chemical constants determined are given below. The details and the subsequent work done will be published elsewhere.

Yield of the fat 38·5 per cent.; Specific gravity at 24° C. 0·9515; Refractive index at 27° C. 1·4780; Acid number 3·98; Saponification value 191·0; Iodine value 88·72; Reichert-Meissel value 1·5; Polenske number 0·46; Acetyl value 5·66; Unsaponifiable matter 0·95 per cent; Melting point of the fat 50° C.

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September 28, 1942.

PRE-SOWING TREATMENT AND PHASIC DEVELOPMENT

HENCKEL AND KOLOTOVA[1] have suggested a method for inducing resistance to drought by repeatedly drying germinated seed. Although such a treatment increased the growth and yield of wheat plants no evidence was presented by these authors to show any acceleration in the developmental phases of wheat. In the course of work in this Institute on the drought resistance of Indian wheats it has been observed that wheat plants grown from pre-hardened seed reached anthesis earlier than those grown from untreated seed. As this observation has not been recorded so far as it has a vital bearing on the theory of phasic development a brief summary of relevant results is presented here. The details of the method used together with the full data will be published elsewhere. It will suffice here to state that the temperature and the duration of the treatment as well as the process of soaking were modified to suit Indian conditions. The treatment was also different in the case of the pot and the field experiments.

The results of the pot experiment (Table I) as well as of the field experiment (Table II) show an acceleration in the development of nine varieties of Indian wheat which though small is clear. The analysis of variance on the data shows that earliness produced by the pre-sowing treatment is very highly significant (at 1% point) for all the varieties. The highest response is of about six days in four varieties (mean of 24 values). Difference between earliest plants in some cases was, however, found to be more than 10 days. Three other varieties, *viz.*, I.P. 111, I.P. 114, Pb. 8-A did not give statistically significant results in both the experiments and therefore are not included in the tables of results. The growth and yield data which will be presented elsewhere clearly indicate that the pre-sowing treatment had a beneficial effect in all respects.

It would be well to point out here that the total time for which the seeds were kept in the swollen condition (germinated) was in all cases 24 hours. It is probable that by increasing the duration of the treatment a greater acceleration in development may be obtained. Experiments are under way to test this point.

In all the varieties the seeds had burst and the embryos were exposd. In some cases, *e.g.*, in I.P. 165, and Pb. 8-A the radicles had emerged. This fact in no way impaired the germinating capacity of the seed even though three successive desiccations after each soaking were given to the germinating seed. On the contrary the rate of germination, percentage germination, and the seedling growth rate were greatly accelerated in some of the varieties.

Another point worthy of note is that the germinated seed was stored for two months after the final desiccation before sowing.

TABLE I

Pot experiment

Wheat (Triticum vulgare)

Sown on 30-10-1941

Variety	Sowing to Anthesis (Days)		Earliness (C–P) (Days)	Treatment variance	
	Control (untreated) C*	Pre-hardening treatment P*		Error variance $n_1 = 1, n_2 = 46$	
			S. E.		
I. P. 4 ..	73·67	67·37	6·(0 ± 1·37	15·30	S
I. P. 112 ..	72·08	69·33	2·75 ± 0·63	15·28	S
I. P. 120 ..	97·67	91·50	6·17 ± 0·67	68·21	S
I. P. 165 ..	73·17	69·25	3·92 ± 0·77	20·87	S
Pb. 9–D ..	105·50	103·29	2·21 ± 0·35	32·33	S
A. T. –38 ..	110·29	104·33	5·96 ± 0·43	145·90	S
C. P. H–47 ..	104·08	98·00	6·08 ± 0·80	46·00	S
Pb. C. 591 ..	100·56	97·58	2·98 ± 0·79	66·48	S

* = mean of 24 values S = significant at 1% point

TABLE II

Field experiment

Wheat (Triticum vulgare)

Sown on 4-11-1941

Variety	Sowing to Anthesis (Days)		Earliness (C–P) (Days)	Treatment variance	
	Control (untreated) C*	Pre-hardening treatment P*		Error variance $n_1 = 1, n_2 = 58$	
			S. E.		
I. P. 52 ..	98·43	96·80	1·63 ± 0·50	10·64	S
I. P. 112 ..	100·06	97·23	2·83 ± 0·63	20·10	S
I. P. 120 ..	105·70	103·00	2·70 ± 0·59	20·60	S
I. P. 165 ..	93·40	89·67	3·73 ± 0·61	37·50	S
Pb. 9–D ..	106·10	102·03	4·07 ± 0·37	122·20	S
A. T.–38 ..	108·00	105·37	2·63 ± 0·54	24·20	S
C. P. H–47 .	107·67	103·17	4·50 ± 1·69	7·09	S
Pb. C. 591 ..	103·73	100·77	2·96 ± 0·45	41·07	S

* = mean of 30 values S = significant at 1% point

In the light of the present findings it may be postulated that there is a separate developmental phase as influenced by desiccation (which may be termed the drought phase).

It also appears that the technique of vernalizing Indian crop plants will have to be considerably modified to obtain results of practical value by combining efforts to induce resistance to drought by pre-sowing treatment and to produce an early crop. Experiments have already been initiated in this Institute to throw more light on this question of agricultural importance.

In conclusion I wish to express my thanks to Rao Bahadur B. Viswa Nath, the Director, and Dr. B. P. Pal, the Imperial Economic Botanist, for providing facilities for work, and for valuable suggestions and criticisms.

J. J. CHINOY.

Botany Section,
Imperial Agricultural Research
Institute, New Delhi,
August 13, 1942.

[1] Imperial Bureau of Plant Genetics, *Bull.*, 1935, 17.

ALBINISM IN SUGARCANE

WHILE surveying the crops grown under sewage irrigation an interesting case of "Albinism" was observed in a local Pounda variety of sugarcane on the Municipal Sewage Farm, Nagpur. A similar case was also observed in Bezon Bagh, Nagpur, where the crop was irrigated with effluent and wet activated sludge. This occurrence was, however, not met with in any other cane field round about Nagpur.

The symptoms are white patches of varying dimensions along the midribs on the lower side of the leaf from the second to the ninth leaf. These patches are from 0·5 to 9·0 cm. in length and are not contiguous. In some cases the intermediate leaves were not affected, while in others all the leaves from the second to the ninth were affected. The patches are slightly raised above the normal surface of the leaf and are bound by a faint yellow margin. Corresponding to the albino areas on the lower surface of the midribs, slight discoloration on the upper surface was also observed which showed itself more prominently when the leaves were held against light. The percentage of affected plants was fairly high, ranging from 20 to 25 per cent.; but no difference in the general development and growth was noticed between the normal and the albino-leaved plants.

Microscopic examination of the affected portions of the leaf did not reveal any difference between the normal and albino parts except that the chlorophyll was observed to have been disorganised in the latter. It was also ascertained that the white patches were not due to any insect, fungal or bacterial infection.

Diseases of sugarcane showing chlorophyll deficiency as recorded by Subramaniam[1] are briefly described below:—

(1) *Sectional Chlorosis*: (Environmental factors—Double effect of cold weather and the presence of water within the leaf culm). Tops of the affected plants show sectional chlorosis.

(2) *Manganese Chlorosis*: (Manganese deficiency in soil solution). Parallel white lines are seen on the leaf-blade due to failing of chlorophyll to develop.

(3) *Dwarf Disease*: (Cause undetermined). Feeble chlorotic shoots commonly arising when infected setts are planted. (Reported only from Australia.)

(4) *Mosaic Disease*: Virus infection.

(5) *Streak Disease*: Virus infection.

From the previous description of the albino patches, it is quite evident that this occurrence is quite different from the diseases so far recorded. It was further interesting to note that these white patches on the midribs were observed only on the crop grown under sewage irrigation and secondly, that the patches were restricted to the lower leaves, new leaves coming after the onset of monsoon being free from them. The monsoon leaves had their normal even green colour. Albinism is generally said to be a hereditary character recessive in its nature. What this albinism is due to is being investigated.

Pantanelli[2] and Church[3] observed a variation in the composition of albino and normal leaves with respect to proteid and non-proteid nitrogen, and ash constituents respectively. Albino leaves show a significantly very high non-proteid nitrogen, potash and phosphoric acid and a low calcium content. Albino and normal green portions were, therefore, collected from the leaves and analysed. The results of analysis are given in the following table:—

Analysis of albino and normal parts

Constituents	Field No. 1		Field No. 2	
	Albino part	Normal part	Albino part	Normal part
	Percentage in air-dry meterial			
Proteid nitrogen	1·10	1·09	1·12	1·09
Non-proteid nitrogen	0·18	0·21	0·18	0·19
Moisture ..	4·15	4·32	3·80	4·07
Ash	9·05	8·80	9·93	9·71
	Percentage in ash			
SiO_2	42·00	39·10	53·70	45·40
P_2O_5	4·59	4·96	3·85	4·14
K_2O	20·60	22·90	21·30	23·60
CaO	7·70	8·96	6·02	6·86

Our results do not show any marked variation in the albino and green portions of the leaves, except rather low silica content and high P_2O_5, K_2O and CaO contents in the green portions.

K. G. Joshi.
D. B. Panditrao.
Agricultural Research Institute,
Nagpur,
September 15, 1942.

[1] Subramaniam, L. S., *Diseases of Sugarcane and Methods of their Control.*

[2] Pantanelli. "Über Albinismus" *in Pflanzenreich f. Pflanzenkrankheiten*, 1905, p. 1 (cited in *Manual of Plant Diseases*, by Paul Sorauer).

[3] Church, "Variegated leaves," *Gardner's Chronicle*, 1877 **2**, p. 586 (cited in *Manual of Plant Diseases*, by Paul Sorauer).

GROUNDNUT OIL FOR DIESEL ENGINES

Since the publication of *laboratory* results on the subject by J. S. Aggarwal[1] and others an opportunity was awaited to supplement the information by results obtained under actual working conditions. The difference in prices of crude oil and groundnut oil and the general apathy and fear for anything new delayed taking any trials so far.

To obtain continuous supply of crude oil in the mofussil is getting more difficult every day. Where the water supply, as of this place, depends for its power requirements ultimately on crude oil and alternative arrangements are not possible, the water service may have to be maintained irrespective of considerations of cost. It was thought proper, therefore, to try groundnut oil (available in plenty locally) as an experiment for future use and guidance.

The local Power House has two *'Deutz'* diesel engines rated 165 bhp. and coupled to a three phase AC generator each. Both the sets have to run together for most of the time the power house is working. Without disturbing the routine work, one of these engines was run on groundnut oil for ten days. It was also possible to run this engine for a short while on 103 kw., its normal load when the consumption came out to be 0·452 pounds per Kwh. Taking the efficiency of the generator as 90 per cent., it works out as 0·303 lbs./bhp.-hr.

The makers recommend light diesel oil (commonly known as "A" grade) for this engine and the test certificate of the engine gives 0·384 lbs./bph-hr. as the consumption of fuel. Presumably, the test is carried out with a fuel similar to "A" grade oil, and comparing these results it can be seen that the groundnut oil bids fair to be a substitute for "A" grade crude oil. However from the end of 1939 to this day, only "B" grade crude oil has been used and now a comparison with this oil shows the following in favour of groundnut oil:—

(1) Absence of black smoke from the exhaust.

(2) Less carbon deposit on the piston top or in the combustion chamber.

A slight deposit of organic matter was observed round the spray nozzle but it did not interfere with the working of the engine in any way. The consumption on an average load of 64 kw. did not materially differ in the case of the two fuels.

These observations are published in the hope that many others will try groundnut oil and pool their experience so that a war-time difficulty may be solved.

R. V. BARAVE.

Willingdon College,
Sangli,

P. V. AMRUTE.

Jubilee Electric Works,
Sangli,
September 7, 1942.

[1] " Indian vegetable oils as fuels for diesel engines," *Bulletins of Indian Industrial Research*, No. 19.

AN UNUSUAL INCIDENCE OF MORTALITY OF MARINE FAUNA*

AN unusual phenomenon of mortality of marine fauna occurred in the tide-pool on the southern (Ceylon) side of Krusadai Island on 17th May 1942. A list of the animals washed ashore along the shore of the tide-pool, which is about twelve furlongs in length from the Sandy Point to the Bushy Point of Krusadai Island is given below. A study of this list would show that a great damage has been done to the reef-fauna of the island. Casualty has been particularly heavy in the case of holothurians and fishes. The casualty of 756 specimens of *Holothuria atra* and 250 specimens of fish embracing 16 genera for a shore line of about twelve furlongs in one day seems to be a record.

Alcyonium pachyclados 5 colonies; *Peachia sp.* 36; *Gyrostoma sp.* 4; *Eurythœ complanata* 23; *Clibanarius longitarsis* 1; *Alpheus rapax* 68; *Palinurus sp.* 6; *Calappa philargia* 2; *Neptunus pelagicus* 21; *Goniosoma sp.* 3; *Atergatis sp.* 6; *Ocypoda spp.* 26; *Gonodactylus spp.* 17; *Squilla raphidea* 3; *Holothuria atra* 756; *H. paradalis* 9; *H. scabra* 23; *Salmacis bicolor* 5; *Pinna æquilatera* 3; *Haliotis varia* 2; *Cyprœa arbica* 9; *C. moneta* 4; *Xancus pyrum* 1; one egg capsule of *Xancus pyrum* with 73 embryos in it; *Aplysia benedicti* 16; *Muræna spp.* 65; fry of *Chanos* 34; *Serranus leopardus* 1; *Therapon jarbua* 21; *Chœtodon collaris* 2; *Heniochus macrolepidotus* 1; *Holocanthus imperator* 24; *Scatophagus argus* 7; *Pterois russellii* 2; *Teuthis marmorata* 4; *Holocentrum rubrum* 36; *Polynemus indicus* 6; *Antennarius hispidus* 1; *Mugil troschelii* 16; *M. waigiensis* 3; *Platyglossus sp.* 18; *and Tetradon sp.* 9.

The causes for this mortality are not definitely ascertainable. *Trichodesmium erythræm*, Ehrenb, the small permanently planktonic alga, was swarming in the tide-pool on the southern side of Krusadai Island from the first week of May 1942; and from the 12th May the tide-pool became densely greenish yellow in colour with *Trichodesmium* and gave a very offensive smell. The gills and gullets of many of the fishes washed ashore were filled with packets of *Trichodesmium*. It therefore seems reasonable to conclude that the fishes were slowly asphyxiated by *Trichodesmium* obstruction before being washed ashore by the high tide that occurred in the night of 17th May 1942.†

But, as the mortality includes also sea-bottom fauna, such as crabs, holothurians, sea-urchins and mollusca, one should hesitate to attribute the disaster to *Trichodesmium* alone. It is suspected, as the sea was rough during those days, that there has been a violent current, churning the bottom of the sea, and involving the fish in the area.

The salinity of the sea water of this tide-pool ranged from 35·59 to 35·91 o/oo, and the surface temperature from 30·1 to 30·5° C. from 12-5-1942 to 18-5-1942.

P. I. CHACKO.

Krusadai Biological Station,
Gulf of Mannar,
June 23, 1942.

* Published with the permission of the Director of ndustries and Commerce, Madras,

† The Group Cyanophyceæ is known sometimes to cause the death of cattle in ponds by toxic secretions. Similarly the *Trichodesmium erythræm* might have produced some kind of toxin causing the heavy mortality of the marine fauna,

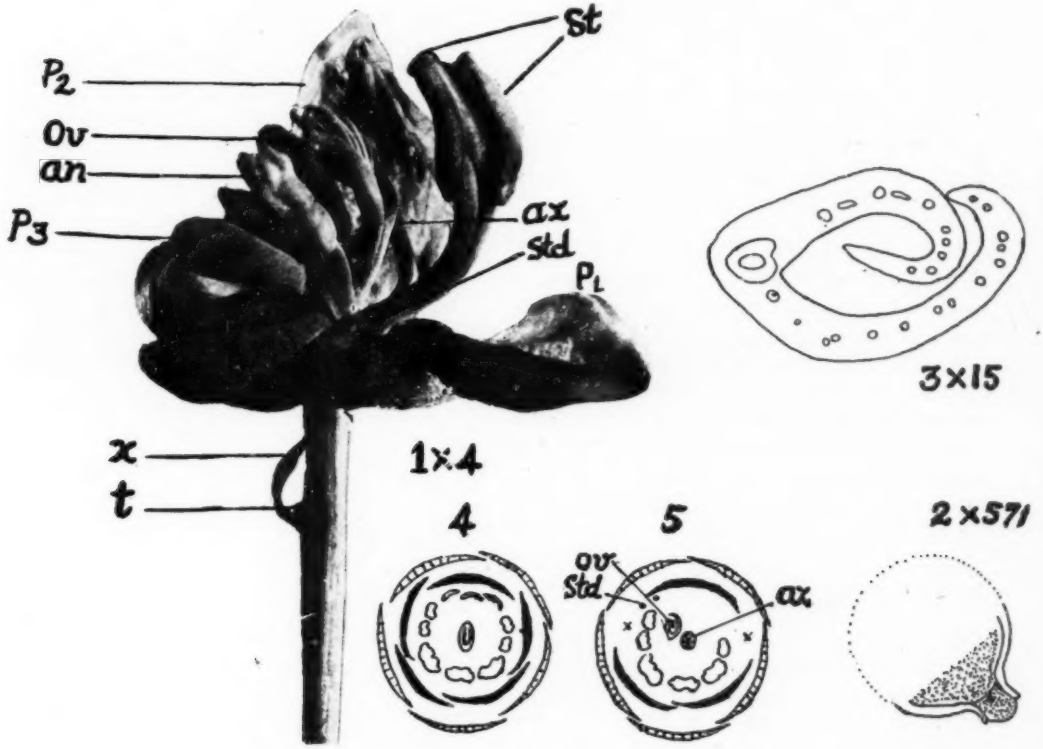
AN ABNORMAL FLOWER OF *CASSIA OCCIDENTALIS* LINN.

An abnormal flower of *Cassia occidentalis* Linn. has been examined (see Figs. 1-5).

(*a*) The unusually thick pedicel bears a short cylindrical appendage (x) in the axil of which is seen a small hump of tissue (t); the nature of these structures is unknown.

(*b*) There are only three petals, the two postero-lateral petals being absent. One of the three petals (p 3) is sepaloid, another (p 1) partly sepaloid.

In the abnormal flower there are six stamens (st) and a couple of small outgrowths, probably staminodes (std). In one of the stamens one anther (an) has become petaloid—a case of petalcidy already noticed in this species by Harris.[1] The anthers are of the normal type and contain normal pollen. A section of one of the undehisced anthers revealed a few pollen grains which had already started germinating with small tubes coming out of the germ pores (Fig. 2). The germination of pollen grains *in situ* is rather unusual but has



FIGS. 1-5

1. Photograph of abnormal flower. 2. Pollen grain germinating *in situ*. 3. Transverse section of the incomplete ovary. 4 and 5. Floral diagrams of the normal and the abnormal flower respectively.

(*c*) In the androecium of the normal flower 3 to 5 of the theoretical number of 10 stamens are either reduced to staminodes or absent; the anthers are basifixed, with porous dehiscence. been noticed in cleistogamous flowers by Madge[2] and West.[3]

(*d*) In the gynaeceum there is no well-defined carpel, but only a thick stumpy

structure (ov) which lies slightly displaced by the proliferating axis (ax); there is no evidence of any style or stigma, nor of any ovules or ovule-like bodies. The ovary-like organ, which is much shorter and thicker than the normal ovary, is not a closed chamber (Fig. 3) but in cross-section appears like an infolded leaf recalling a transition stage in the familiar derivation of a closed ovary from a leaf by the infolding of the margins. Both the inner and the outer surface of this 'ovary' are covered by hairs (not shown in Fig. 3). It is possible that this structure is a case of 'phyllody' of the carpel, of which several examples are given by Masters[4], Worsdell[5] and Kausik[6] though not in this species. My specimen differs from these in the absence of all trace of ovules or ovule-like bodies, and in the fact that the 'ovary' is not leaf-like in form but to all appearance looks like an ovary, only a section showing a resemblance to a transversely cut leaf blade.

(*e*) In the centre of the flower occurs a small shoot (ax) bearing a pair of young compound leaves with a growing stem tip between them—obviously a case of proliferation, many examples of which are cited by Masters (*l.c.*, p. 138) and by Worsdell (*l.c.*, pp. 16-17). The basal part of this axis is fused up with the stalk of the imperfect 'ovary' which has been displaced to one side by the axis. Masters (*l.c.*, pp. 139, 258) says that in proliferated flowers the pistils become 'disunited and leaf-like', a condition seen also in the flower here described.

The nature of the stumpy appendage (x) borne on the pedicel is difficult to determine. It may be a bract carried up on the peduncle, while its axillary hump (t) may be a foliar or flower bud, and this seems plausible in view of the proliferation of the vegetative axis through the flower. Another possibility is that it is a much reduced leaf bearing in its axil a gland similar to those that occur normally in the leaf axils of this species. Or the hump may be an undeveloped leaf bud, while the stump is stipular in nature.

The flower is interesting because it combines in itself a number of abnormalities, *e.g.*, petalcidy, suppression, phyllody, proliferation, etc., some of which have not been described in this plant.

My thanks are due to Mr. B. B. L. Srivastava, B.Sc., who drew my attention to this flower.

A. R. Rao.

Department of Botany,
University of Lucknow,
September 5, 1942.

[1] See Penzig, *Pflanzenteratologie*, 1921, **2**, 280; the original work by Harris has not been seen by me.

[2] Madge, *Ann. Bot.*, 1929, 545–77.

[3] West, *Ibid.*, 1930, **44**, 87–109.

[4] Masters, *Vegetable Teratology*, 1869, 256.

[5] Worsdell, *Principles of Plant Teratology*, 1916, **2**, 123–24, 193–95.

[6] Kausik, *New Phytol.*, 1938, **37**, 396–408.

ON THE ALLEGED INHIBITORY INFLUENCE OF *TRICHODESMIUM*

On page 243 of *Current Science*, Vol. 11, No. 6, dated June 1942,[1] John and Menon observe: "..... our observations in regard to certain points dealt with by Devanesan are at variance with his."[2] The alleged inhibitory influence of the alga *Trichodesmium* in the Travancore coast should be a regional one. The observations made in this Biological Station from 1924 lead one to infer that the inhibitory influence of *Trichodesmium* is due more to its occasional profusion[3] than to its unpalatable qualities. It seems to be a case of glut in the sea when on account of the sheer thickness of the floating *Trichodesmium* layer, the fish may react negatively to it. *Trichodesmium* has been recorded here as an occasional item of diet of the Mackerel, the Oil-sardine, the Sprat (*Sardinella gibbosa*) but frequently enough not to be regarded as accidental inclusions in the diet.

Another case in point is the Cystoflagellate *Noctiluca* whose swarms are alleged to cause

even local scarcity of the Oil-sardine shoals. Even *Noctiluca* is not free from being accidentally eaten by fish, for recently on 30-7-'42, a specimen of *Leiognathus splendens* examined here had *Noctiluca* in its stomach.

The explanation for the absence of fish-eggs in the stomach contents of the Oil-sardine and the Mackerel may be very simple after all, if one investigates the presence or absence of fish-eggs in the area. If the sea off Travancore is not a breeding-ground for fishes in general during the period when the shoals of these two fishes appear there, then it would be unreasonable to expect fish-eggs in their food. The sea opposite West Hill abounds in fish-eggs during certain months when the Oil-sardine and the Mackerel appear.

K. CHIDAMBARAM.

West Hill,
August 22, 1942.

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[1] John and Menon, *Current Science*, 1942, **11**, 243.
[2] Dr. Devanesan, *Ibid.*, 1942, **4**, 142.
[3] Gilchrist, *Marine Biological Reports* (Union of S. Africa), 1914, No. 2.

IT is not our intention to criticise or dispute the observations made by Dr. Devanesan. From Mr. Chidambaram's note it is evident that the inhibitory influence of *Trichodesmium* on fishes is a phenomenon which has been observed in the West Hill Biological Station also. Citing Gilchrist he says that this phenomenon is due more to its (*Trichodesmium*) occasional profusion than to its unpalatable qualities. In our previous note it was pointed out that large patches of *Trichodesmium* appear in the inshore waters of this coast at irregular intervals during December to April. When it occurs it does so in great numbers. During other months it is absent from the plankton. It is therefore natural that *Trichodesmium* occurs very rarely in the gut contents of the fishes of this coast. Mr. Chidambaram does not give any information regarding the seasonal distribution of the alga in the Calicut waters. A comparison of its seasonal variations in the two regions might explain the far too great frequency of this alga in the gut contents of the mackerels and other fishes of the Calicut coast.

Mr. Chidambaram observes that the absence of fish-eggs in the dietary of the Oil-sardine and mackerel can be explained "if one investigates the presence or absence of fish-eggs in the area". Our investigations have shown that fish-eggs are a common feature of the plankton of this coast during the mackerel and sardine seasons. So Mr. Chidambaram's hypothesis does not explain the absence of fish-eggs in the dietary of the Oil-sardines and mackerels of this coast.

C. C. JOHN.
M. A. S. MENON.

Marine Biological Laboratory,
Shankummughom, Trivandrum,
September 15, 1942.

STUDIES IN PHILOSOPHY

I THANK the reviewer for the generally appreciative tone of his review of my book "Studies in Philosophy", appearing in the July 1942 issue of *Current Science*. But it is my duty to offer a few words to correct certain misapprehensions that may be caused by some of his critical remarks.

1. Dr. Sarma objects to my characterisation of Dvaita as a species of Concrete Idealism.... ..... I would only say that in my considered opinion that phrase 'Concrete Idealism' is less misleading than Dr. Sarma's Radical Realism. Ontological idealism is quite consistent with epistemological realism. Idealism is protean in its forms. Parmenides, Plotinus, Kant and others belong to one type. But Hegel, Lotze, Pringle, Pattison, Sir Henry Jones and others belong to another. Dvaita resembles the latter in essential respects. Further, Dr. Sarma's critical note on terminology is rather misleading regarding the point and scope of my

chapter on the Notion of Difference. My treatment is devoted entirely to an exposition of the realist answer of Dvaita to the idealist denial of the existential status of difference by Advaita. I expect my readers to estimate the value of the Dvaita answer to the Advaita critique of difference. My characterising phrase of Dvaita as concrete idealism may be dropped without affecting the value of the discussion.

2. Dr. Sarma considers the analogy that I have drawn between Bradley's doctrine of "My Station and Its Duties" and the Gita account of "Swadharma" a case of doubtful parallelism. Perfect parallels are impossible, but vital resemblance is possible and is really exemplified here. There is nothing in the Gita to preclude the possibility of "Peons and Prime Ministers" with salaries from converting their daily humdrum occupation into a medium of self-realisation, provided they go about it in the spirit of self-dedication. There is no gulf between special religious ritual and secular vocation as media of attainment. .....

I must add that these comparative studies of mine have no motive other than the pursuit of truth. They may or may not contribute to the rapprochement of East and West. People with identical views may entertain feelings of mortal enmity with each other. .....

However, it is gratifying that my humble efforts should remind Dr. Sarma of Hegel's philosophic equanimity in time of war and of India's eternal quest in cultural endeavour.

M. A. VENKATA RAO.

Bangalore,
August 18, 1942.

..... I made it perfectly clear in my review that while Dvaita is *not* at all idealism, its description as "concrete idealism" must be a distortion. ..... My stand has always been, whatever is connoted by Sankara's idealism, that is refuted by Madhva's realism. Thus, Sankara's being radical idealism or absolute idealism, Madhva's must be absolute or radical realism. Madhva's is all-round realism—ontological, psychological, epistemological, *et hoc*.

..... From Bradley to Sankara it is indeed a far, far cry. Having decried all activity, Sankara offers a constructive substitute in knowledge. Bradley does nothing like that. The gulf between the two in this respect is unbridgeable. The Gita ideal of Swadharma is strictly based on realisation of instrumentality in the hands of Divine Agency. Bradley makes no such theistic appeal. Viewed from whatever standpoint, parallelisms between Bradley and Sankara must be far-fetched and strained and doubtful.

Indian philosophy must stand on its own merits quite apart from the fact of its acceptance by the West. Thus comparative studies should always be based on real, and rational parallelisms. They have an end in view. That may be correct interpretation of Eastern thought to the West. I have always held that doubtful or superficial parallelisms defeat their own purpose.

R. NAGA RAJA SARMA.

Madras,
September 6, 1942.

[Owing to the necessity to economize space, we have had to omit some passages from both the letters. But no passage, material to the subject has been omitted.—ED., *C. S.*]

REVIEWS

Catalysis Inorganic and Organic. By Sophia Berkman, Jaque C. Morell and Gustav E. Gloff. (Reinhold Publishing Corporation, New York, U.S.A.), 1940. Pp. 1130. Price $18.00.

The subject of catalysis, both positive and negative, is of immense importance not only from the point of view of theoretical Chemistry but also from that of industrial Chemistry. The importance of this subject and the outstanding achievements of Ostwald, Sabatier, Haber, Bosch and Bergius in this field of study have been recognised by the award of Nobel Prizes in Chemistry to these world famous workers. If the phenomena of fermentation, photosynthesis in plants and biological oxidations in which catalytic reactions play an important rôle are included in this branch of knowledge, the names of Nobel Laureates like Buchner, Willstatter, Harden, von Euler, Meyerhoff, Warburg, St. Gyorgy, Hopkins and Neuberg appear in the forefront. Among the major industrial developments in Chemistry during the last fifty years, one may mention the contact method of manufacturing sulphuric acid, the synthesis of ammonia and its oxidation by air, the hydrogenation of oils and coal, the synthesis of numerous useful organic substances by catalytic dehydration, dehydrogenation, etc. The revolution in petroleum industry by catalytic polymerisation, catalytic hydrogenation, catalytic alkylation, catalytic isomerisation, catalytic cracking, catalytic reforming, etc., and the preparation of synthetic motor fuels by the catalytic hydrogenation of carbon monoxide, and of synthetic lubricants by polymerisation of olefines in presence of aluminium chloride constitute new advances of far-reaching importance. Many of the modern synthetic plastics and resins may be prepared by catalytic process from acetylene, ethylene or other substances obtained from petroleum and natural gas. The starting materials for the various synthetic rubbers are butadiene, isoprene, dimethyl butadiene, isobutene, chloroprene, styrene and acrylnitrile. The Buna rubbers prepared on a commercial scale in Germany are polymers or mixed polymers of butadiene catalytically synthesised from acetylene: acetylene-acetaldehyde-acetaldol → butene-glycol-butadiene-rubber polymers. The authors have brought out an important volume consisting of 1130 pages dealing with the different aspects of this phenomenon of catalysis. In the first few chapters the theoretical aspects of absorption, heterogeneous and homogeneous catalysis have been carefully discussed. Chapter 4 deals with the activity of the catalysts, Chapter 6 with promoters and poisons in catalysis, Chapter 7 carriers in heterogeneous catalysis, Chapter 8 catalytic reactions in organic and inorganic chemistry, and Chapter 9 physical conditions in catalytic reactions. Everywhere emphasis has been given to practical aspects of the subject. In Chapter 10 of nearly 350 pages, an attempt has been made to classify catalytic reactions in the different groups. This is a laudable and serious attempt at giving an orderly presentation of a subject which is growing extremely rapidly. The last chapter deals with catalysis in the petroleum industry, a subject in which the authors have to their credit important published researches. As promoters are of special interest and important chiefly in numerous catalytic gaseous reactions, great emphasis has been laid on this subject, the mechanism of which is far from clear.

The subject of negative catalysis is also of very great practical importance. Just as acceleration of a chemical change by catalysts has been utilised in numerous industrial operations, the retardation of a chemical change by a negative catalyst is also of great consequence. In the last European War, large quantities of sodium sulphite in a hydrated form were sent out from Europe to Mesopotamia for use as an antichlor to be utilised by the British troops for water purification. When this substance reached the destination it was wholly converted into sodium sulphate and was completely useless as an antichlor. Research work was initiated to discover a retarder for the oxidation of sodium sulphite by air and after a strenuous effort it was found that very small quantities of hydroquinone practically stopped the oxidation. Similarly by the addition of suitable negative catalysts, oils and fats, chloroform, ether, etc., can be preserved from oxidation and this use of

antioxidants has led to important industrial developments. Physiologists discovered that carbohydrates and fats, especially the former, can preserve the body proteins. This is also a part of the phenomenon of negative catalysis. Similarly carbonaceous substances preserve the soil nitrogenous compounds by acting as negative catalysts in the soil oxidation reactions.

Hence there is a great rush for the discovery of suitable positive and negative catalysts. The discovery that vanadium pentoxide can replace the costly element platinum in the manufacture of sulphuric acid has been a great boon to the sulphuric acid industry. The replacement of platinum in the oxidation of ammonia to nitric acid by air is a big problem for workers on catalytic reactions and if a cheap substitute is discovered it is likely to revolutionise the nitrogen industry. The authors have attempted to bring order in this subject which has developed at a tremendous speed during the last hundred years and they have been successful in presenting the subject systematically. This book will prove useful not only to academic chemists but will be largely utilised by industrial and manufacturing chemists.

N. R. DHAR.

An Introduction to the Chemitsry of Cellulose. By J. T. Marsh and F. C. Wood, with foreword by Sir Kenneth Lee. (Chapman & Hall, London), 2nd edition, 1942. Pp. xv + 512. Price 28*sh*.

This new book on the subject of cellulose chemistry has been written by two of the most successful scientific workers in the field of textile chemistry, who have to their credit the distinction of having achieved marked developments on the commercial side also. The subject has been dealt with not only to cover the latest researches in the subject from the point of view of the academician, but also to provide a guide book for the practising technologist, though for the latter, it would have been more useful if some information regarding the nature and types of plant commonly used had also been included. The authors however did not propose to include them as is evident from the title of the book.

The subject-matter has been divided into five distinct parts. In the first part, details have been given of the various types of impure celluloses obtaining in nature, their occurrence, quality, and methods of commercial purification. The general physical properties of cellulose, particularly those having a bearing on moisture absorption, and some optical, electrical, and mechanical properties have been fully discussed. In the second part dealing with the constitution and structure of cellulose, the authors have compiled complete evidence to establish the final chain structure of the cellulose molecule. The molecular weight data obtained by various investigators using diverse physical and chemical methods including some of the latest work involving the use of ultracentrifuge, X-rays, or viscosity studies have been taken into consideration. Allied studies regarding the structure of synthetic fibres such as Vinyon, and Nylon, and of regenerated fibres have been included, along with information regarding the chain structure of molecules in animal fibres such as silk and wool, to establish the final structure of the cellulose molecule by comparison. The important work of Meyer and Mark, and the data obtained in the X-ray examination and swelling studies of celluloses in their relation to establishing the molecular structure of cellulose, have all been fully dealt with. The subject of disperse cellulose dealing with Neale's Theory, mercerisation using various alkalis and organic bases, dispersion of cellulose using hygroscopic substances—inorganic acids and salts,—dispersion using specific reagents such as cuprammonium hydrate, carbon bisulphide and sodium hydroxide, and chloral, and finally the properties of the dispersed celluloses have been exhaustively considered in part three. The subject has been specially considered not only from the scientific point of view but also from the technological aspect, giving details of manufacturing conditions. Part four deals with the modified celluloses—hydro-cellulose and oxy-cellulose—and their properties. Some of the industrially important cellulose derivatives have been described in part five. The esters of inorganic acids, particularly the cellulose nitrate and its derivative rayon, the organic esters, with special reference to cellulose acetate, mixed esters, ethers, amino-celluloses and finally the most important soda cellulose and cellulose xanthate have all been described giving each the importance it deserves. The book has been nicely concluded with detailed description of the manufacture of viscose and some general considerations about cellulose and its rôle in our daily lives.

Close co-operation between the science and technology of textiles has had already a profound effect on the development of the textile industry and further advances can be ensured only by knitting a closer bond between the two. For persons engaged in industrial production and process control, who do not ordinarily have sufficient time to keep abreast with the theoretical developments in the subject, this book satisfies a real need, giving not only a connected account of the latest developments but also a complete bibliography. For the research worker just entering the field, the book is valuable in enabling him to pick out the important previous investigations without having to wade through the maze of patent specifications and diffused scientific literature.

The authors themselves being successful practising technologists working on the commercial side, details of technical processes given by them should be trustworthy and form a useful guide to the practical man. The book has been well planned and written in a readable style, although the very frequent introduction of references in the middle of sentences leads to rather discontinuous reading. But possibly the extensive literature cited by the authors could not be compiled at the end of chapters without causing other difficulties. It may have been better to insert them in the form of foot-notes in each page, with corresponding reference numbers only in the body of the text.

The X-ray and micro-photographs given in the book are about the best that have been so far published anywhere on the subject.

Although the first edition of the book was published only in 1938, extensive investigations on the subject during the last three years have made it necessary for the authors to bring out the new edition which they have done both justifiably and creditably.

A. N. Rao.

The Chemical Analysis of Ferrous Alloys and Foundry Materials. By E. C. Pigott. (Chapman & Hall, London), 1941. Pp. xv + 362. Price 28*sh.*

This is an excellent book on the technical chemical analysis of iron and steel and foundry materials. It covers 28 elements including the so-called rarer alloying elements like Beryllium, Boron, Cerium, Selenium, Tellurium, Columbium and Tantalum, which are now being used with sufficient frequency to merit inclusion of methods for their determination. Incidentally the introduction of more complex ferrous alloys had rendered some of the old standard methods of analysis obsolete and necessitated revision to meet the modern practice.

The book under review while meeting this need has some special features. The methods have been judiciously selected and brought up to date, several comparatively modern methods also finding their place. A discussion of the properties of each element and its relevant compounds and the theoretical considerations on which the principle methods of separation and determination are based precede the methods in the selection of which preference has been given to those methods which are of direct nature or of wider application. The methods of analysis which are given in sufficient detail are followed with explanatory notes giving the reactions involved in each step and the exact importance of various stages, thus giving the analyst a thorough grasp of the subject.

The chapter on definitions, many of which are very elementary, could have been usefully omitted. The generous use of equations, again many of which are too elementary, could have also been avoided. The publication is compact and almost free from errors.

Mohamed Ali.

Intermediate Quantitative Analysis. By Welch. (University Tutorial Press, Oxford), 1941. Pp. 128. Price 3*sh.* 6*d.*

As usual this book describes the century-old (the so-called standard) exercises in volumetric and gravimetric analysis that form part of the curricula of studies for the undergraduate in all universities. It can at once be said that Section 2 is an apology for gravimetric analysis, despite the fact that gravimetric analysis lends itself to high order of accuracy. The author cannot be oblivious to this fact as is evident from his remarks in the introduction to the work and yet has caused a paucity of exercises in this branch.

The book opens with a description of the analyst's tools, such as the balance, burettes, pipettes, weighing bottles, etc., followed by exercises in acidimetry, alkalimetry, oxidation and reduction principles, iodimetry and precipitation methods. They are of a very representative character; additional exercises are appended to each chapter, which

are obviously intended for the student of leisure. The book is well illustrated with diagrams of apparatus which the students will be called upon to handle in the course of their practical work; the need to work with solutions of approximately equal strength is well brought out; the preparation and storing of standard solutions is neatly and lucidly described; the calculation of errors and their sources are briefly pointed out; the author remarks that the strengths of solutions must be consistently expressed in decimals of normal solutions, *e.g.*, 0·1035 N. The work abounds in samples of calculations from experimental data.

The author graduates his scale over which the pointer of the balance swings from 0 to 200 (Fig. 2, p. 5). There is no particular advantage to be gained by using such large figures but this may even lead to positive confusion, remembering the fact that in their high school and Intermediate career, students are used to smaller figures as 0 to 20 or 10 to the left and 10 to the right; internal, external and adsorption indicators have been very briefly described and their theory, so vital for a work of this kind, has been severely left out and the student is asked very politely to refer to advanced works in Physical Chemistry (p. 26); estimations of Calcium indirectly, and Lead, directly and indirectly, have been omitted. It augured a very happy future when sintered glass funnels were ushered into analytical work but one is disappointed to note that the author has not prescribed any exercise involving their use.

The book is carefully printed, neatly bound, is handy and can be safely placed in the hands of B.Sc. students of Indian universities.

K. RAMI REDDY.

A Manual of Geometry. By N. K. Narasimha Murthy. (Prabhakar Book Depot, Fort, Bangalore), 1942. Pp. 120. Price Rs. 1-4.

This neatly got-up little book is the latest of its kind and is chiefly intended to meet the needs of the Intermediate of the Mysore University. The subject-matter has been arranged in logical order and the exposition is clear and simple throughout. The early introduction of 'Medial Section' closely following up the Problems on Areas is commendable. But, by changing the classical order of treatment in the chapter on 'Ratio and Proportion', the author has slightly marred the continuity of thought and has relegated to the background fundamental and elementary methods of demonstration for the sake of certain ingenious proofs, which can always be given as an alternative. It is also to be regretted that the attention of the student is not drawn properly and fully to 'the properties of harmonic ranges'. The propositions are followed up, wherever possible, by interesting foot-notes which adumbrate the use and importance of the theorems. Many model examples and important geometrical constructions have been worked out for the benefit of the student. The book contains a fairly good number of examples illustrative of the theory, though the miscellaneous collection is very meagre. On the whole, it can be said that this book is bound to be a valuable guide to the Intermediate students of the Mysore University for purposes of a written examination.

S. KRISHNAMURTHY RAO.

Modern Inorganic Chemistry (in Tamil), Part II. By N. Ananthavaidyanathan. (Annamalai University, Annamalainagar), 1941. Pp. viii + 642. Price Rs. 2.

This is Part II of a pioneer attempt to write chemistry for the colleges in Tamil. The language is free, easy reading and accurate. An interesting feature of the book is the biographical and historical details as also the appropriate references in the form of extracts from Sanskrit and Tamil literature, to the chemical knowledge of our ancients. The chapter on qualitative analysis and metallurgy are particularly well written and shows the vast experience of the author in teaching the subject. Advanced matter not intended for the Intermediate classes is printed in small type. The many diagrams and photographs are clear-cut. Nearly 120 pages of this volume are devoted to equivalents of scientific nomenclature and terminology of chemicals, to an author index and to a subject-index. The get-up of the book is good. The author and the University are to be congratulated for this excellent work.

The reviewer feels that the intolerable situation with regard to the Tamil equivalents of chemical nomenclature and terminology might be ended if the equivalents given in this book be adopted as they have been formed with due regard to their usual and full significance.

While the page numbering of the second volume is started fresh, the numbering of figures continues from the first volume. It is rather inconsistent with the principle of retaining the universally accepted abbreviations in this vernacularisation that 'Centigrade' is represented by '°' and not by 'C'. While the author transliterates the word 'Lithium' it is unnecessary to show (p. 100) how the same might be called 'தோரிய மகலம்'. The reference to Thiruvannamalai on the same page, the paragraph on Mn dificiency diseases and their cure by rice husk (p. 404) the example of lead poisoning through use of 'ஈய குளாய்', the diagram on page 381 and similar things may be omitted from a text-book on Inorganic Chemistry.

The success of such enterprises as these could be judged only when universities follow their encouragement of such efforts by making use of these books.

Bharatiya Vaignanik (Indian Scientists). By Shyam Narain Kapur. Sahitya Niketan, Cawnpore), 1942. Pp. 364. Price Rs. 3.

An account is given in this book of the lives and works of the following twelve Indian scientists of international repute, namely, Dr. Mahendralal Sircar, Srinivas Ramanujan, Dr. Ganesha Prasad, Sir J. C. Bose, Sir Shah Sulaiman, Sir C. V. Raman, Sir P. C. Ray, Dr. Meghanath Saha, Dr. Birbal Sahani, Sir S. S. Bhatnagar, Dr. K. S. Krishnan and Dr. H. J. Bhabha.

This is perhaps the first book of its kind in Hindi and is sure to be of great value to readers of Hindi in understanding the achievements of persons whose biographies have been treated in the book. Without going too much into technicalities, the author has attempted to present to the ordinary reader the nature and substance of the researches carried out by each of the dozen scientists and the serious handicaps under which some of them had to labour on account of their country not being politically free. The author has taken great pains to collect information which is both accurate and interesting. The biographical sketches and the delineation of the personal traits and even the idiosyncrasies of some of these pioneers in science make interesting reading and remind one of the fact that scientists, though engaged in dry and abstruse pursuits in secluded laboratories, *are* as human as the poet or the novelist, a fact which is commonly ignored.

The book is illustrated and the printing and get-up are good though one would wish that for a book of this kind the types selected were bolder than the ones actually used.

M. V. JAMBUNATHAN.

OBITUARY

Dr. V. NARASIMHA MURTHY, B.Sc., M.B. & B.S., D.P.M., D.T.M., Dr.Ph.

WE deeply regret to record the demise of Dr. V. Narasimha Murthy at the prime of his scientific career. He was under forty.

Graduating from the Central College in 1924, he was one of the first to take his M.B. & B.S. degree of the Mysore University. As House Surgeon in the Victoria and Krishnarajendra Hospitals, he displayed an unusual keenness for research which received early and handsome recognition by the Government. He was entrusted with the investigation of typhoid and cholera in various parts of the State, which he carried out with praiseworthy enthusiasm, devotion and thoroughness. He took up the study of guineaworm disease prevalent in Chitaldroog; these studies won for him recognition as a research worker of great promise. He was deputed to the School of Tropical Medicine at Calcutta and spent some time at the Haffkine Institute at Bombay.

He was chosen as the Rockefeller Scholar and sailed for America in 1936. On his return to India in 1938, he had fewer opportunities for pursuing his scientific research. He fell a victim to the disease which he was investigating and the best medical aid that was rendered to him could not save a precious life so full of promise in the field of scientific research.

Dr. Narasimha Murthy was an endearing and loyal friend and as a scientific investigator, he was highly esteemed by his colleagues.

We wish to offer our sincere condolences to his bereaved family.

CENTENARIES

Manning, Robert (1784-1842)

ROBERT MANNING, an American pomologist, was born at Salem, Mass., July 18, 1784. His business was first that of a broker and later that of a stage-coach manager. In 1817, he began in a small way to collect choice varieties of fruits. In 1823 he established a pomological garden. Getting into touch with many noted fruitmen of Europe, he imported many scions and trees of choice varieties, in spite of the risks due to the slowness of pocket boats in those far-off days. At the time of his death he is said to have possessed the finest collection of fruits in America and one of the best in the world, consisting of over 1,000 varieties of pears alone and nearly as many more of the other fruits combined. His *Book of fruits* (1833) is a valuable catalogue of many "varieties of pear, apple, peach, plum and cherry" and is responsible for having established correct nomenclature of fruits and means of identification.

Manning died October 10, 1842.

Wigner, George William (1842-1884)

GEORGE WILLIAM WIGNER, the founder of the Society of Public Analysts, was born at Lynn October 19, 1842. Though he showed a liking for chemistry, he had to find employment in a bank for the first five years. After hearing him give a scientific lecture, Mr. Frank Hills employed him in his chemical works, where he remained for four years taking out several patents for sewage treatment. By 1872 he began independent business. During the next twelve years he published twenty-five papers and two books: the *A.B.C. of sewage process* and the *Seaside water*. Wigner took an active part in promoting the Sale of Food and Drugs Act of 1875. In the same year he founded the Society of Public Analysts and was the editor of the *Analyst* from its inception till his death. In 1880 he was rewarded by the National Board of Trade of the U.S.A. for drafting a Food and Drug Bill for them. In 1884 he acted as a juror in the International Health Exhibition at London and analysed some hundreds of food samples exhibited.

Wigner died of stricture of the œsophagus October 17, 1884.

Howell, Thomas Jefferson (1842-1912)

THOMAS JEFFERSON HOWELL, an American botanist, was born at Pisgah, Montana, October 9, 1842. He went to school only for six months; but he acquired a little knowledge of English and Latin by his own efforts. He was a farmer; but he soon developed an interest in studying the flora of his district and built a herbarium, which contained about fifty new species. *Picea brewariana* is said to be one of the discoveries of Howell and it is claimed that it should have been named *Picea howellii*. By 1887 he was in a position to publish *A catalogue of the known plants of Oregon, Washington and Idaho* which was the first book of the kind for that region. He next thought of publishing a flora for the same region. But as he was too poor to pay the printer, he learnt the compositor's art and though he was too illiterate even to syllabify words, he composed and printed his *Flora of North America* between 1897 and 1903. This is said to be still the only flora for the three States it covers.

Howell died at Portland December 3, 1912.

S. R. RANGANATHAN.
University Library,
Madras.

SCIENCE NOTES AND NEWS

Vitamin Content of Honeys.—Honeys obtained from various regions of Minnesota, from other localities of the U.S.A. and a few samples of foreign honeys, when tested by microchemical and microbiological methods for the presence of various vitamins, were found to contain thiamine, riboflavin, ascorbic acid, pyridoxine, pantothenic acid and nicotinic acid (*J. Nutrition*, 1942, 23, 280). The different samples showed a considerable variation in their vitamin content, which is given below. It is suggested that these variations may be partially due to the variable amounts of pollen present in honey.

Thiamine 2·1-9·1 μg./100 g. Riboflavin 35-145 μg./100 g. Pyridoxine 227-480 μg./100 g. Pantothenic acid 25-192 μg./100 g. Nicotinic acid 4-94 mg./100 g. Ascorbic acid 0·6-6·5 mg./100 g.

The samples of honey tested appear to be rich in pyridoxine, pantothenic acid and nicotinic acid.

Clarification with diatomaceous earth, although it increases the attractiveness of honey, tends to reduce its vitamin content; hence it is recommended to avoid such a procedure.

K. B.

Micro-Straining for Water Purification.—Until recent years, large-scale open strainers were not considered for any duty other than the removal, from flowing water of the larger floating and suspended solids. For the removal of finer suspended impurities, flocculation, sedimentation, and sand filtration were used, these processes being employed alone or in combination. Fine strainers could not be used except

for water with very low suspended content, due to the rapid blockage to which fine screens were subject. With the advent of automatic rotary type continuously self-cleaning strainers, it has become practicable to employ fine screens of the order of 100 to 150 mesh with apertures 142μ to 89μ. According to D. L. Boucher (*Engineer*, 1942, 163, 420-2, 445-7) it is now feasible to produce and use very much finer microstraining medium by controlled bright electro-plating of nickel on 325 mesh wire cloth. The original apertures in the 325 mesh of 39μ, can be plated down to 25 to 5μ, with a parallel increase in strength of the cloth and resistance to corrosion. From considerations of flow capacity and straining efficiency, the most effective aperture is found to be 15 to 25μ (average 20μ). For a river water containing not more than 2 parts per 100,000 of suspended solids, the "rating" for a 1" difference of level is 174 "vertical" feet per hour, compared with 19' to 38' per hour for rapid sand filters. The plated wire cloths can be used with waters with pH values 5·5 to 9·0, thus covering all ordinary natural and industrial waters. Arrangements are in progress for a standard self-cleaning rotary strainer of 100,000 gallons per hour capacity fitted with microstrainer cloth, to be installed by one of the largest English undertaking.

Public Health and Nutrition.—Writing in the *Indian Medical Gazette* (September 1942, 77, No. 7) W. R. Aykroyd says that there is no lack of evidence that nutrition is a factor of basic importance in public health. The first essentials for the prevention of disease are higher standard of health, a healthy physique and a greater power of resistance to infection. These can only be attained if food of the people is such as will give all the physiological and nutritional requirements of the human frame. Actually it is quite impossible to make any satisfactory quantitative assessment of faulty and insufficient diet as a disease-producing factor in India. Some light may however be thrown on the question by the study of available morbidity and mortality statistics.

At present there is very little accurate information about the causes of the high infantile mortality in India. As an example of how a deficient maternal diet may profoundly influence infantile mortality may be mentioned the incidence of high mortality in breast-fed infants, due to infantile beri-beri in the Northern Circars. In any ill-fed population group whether human or animal it is the newly born and the very young that suffer most severely from ill-effects of malnutrition. The causes of high infantile mortality in India have not been fully investigated. In this connection the observations of Hass (1940) in Java are significant. There is no reason to suppose that the state of nutrition of poor children in most parts of India is in any way better than that of children in Batavia, and the conclusion of Hass, that malnutrition is a major factor in causing disease and death in young children, can probably be applied to India. As regards maternal mortality, while a quantitative assessment is impossible it is reasonable to suppose that diet deficiency is responsible for much of the illness among pregnant women in India.

Regarding the relation between nutrition and various common diseases of India it may be of interest to note the effect of famine on birth rate, death rate and the influence of food scarcity and famine on the incidence of various diseases. A large percentage of the population in India lives on a diet which is defective in quality and often in quantity. It is not unreasonable to suppose that the incidence of diseases which become more prevalent in times of food scarcity is influenced by diet in normal times.

The vital statistics of India, inaccurate though they may be, provide clear indications that nutrition work is an essential part of public health activity. The improvement of diet is of essential importance if the goal of a healthy nation is to be attained.

Emergency Economies in Tin.—Both in the United States and in Great Britain every use of tin is scrutinised by groups of experts, in order to effect the utmost economy in the use of the very limited supplies of tin at present left to the United Nations. This is sought to be achieved not by a flat percentage reduction but by demanding the intelligent co-operation of every user, so that these economies are compatible with a minimum of reduction in the war effort. The Tin Research Institute, whose original object is to develop new and increased uses of tin, are now collaborating in devising methods and processes for the most efficient use of the available supplies. Thus the current number of *Tin and Its Uses* (No. 13), July 1942, discusses the advantages of thinly coated electrolytic tinplate as a substitute for ordinary tinplate and describes an automatic plant suitable for plating batches of standard sized sheets. Other articles on "Bearings with less Tin" and on "Economy of Tin in solder" deal with the same economy theme. Many of these efforts are besides bound to be of permanent value. Thus, instead of a normal plumber's wiped joint, it is found that lead pipes can be very effectively jointed by sweating with solder foil a pair of suitably shaped cup and cone ends and at the same time a 99 per cent. saving in tin effected.

Use of Colchicine in Preventing the Development of Plant Tumors.—Crown gall of apple, tumors on "paris daisy" have been the object of serious investigation by both pathologists and anatomists. The tumors greatly impair the vitality of the plant, and are caused by *Bacterium tumefaciens*. Recently, Brown (*Phytopathology*, 29, 221-31 and 32, 25-46) has shown that their development can be controlled, if not prevented by the use of colchicine. Young tumors on tomato, marigold, Bryphyllum and others were dusted with colchicine. After three or four weeks the tumors showed distinct shrinkage and actually disappeared in some cases. The same results were, however, not obtained by the use of the other chromosome doubling substances such as acenapthene, α-methylnaphthalene, α-nitronaphthalene and others.

M. J. T.

Palaeobotany in India.—The third number of the Progress Report (for the year 1941) on Palæobotany in India, published at Lucknow under the editorship of Prof. Birbal Sahni, F.R.S., which has just been issued, opens with an Obituary Note on the death of Albert Charles Seward, the doyen of palæobotanists "whose noble personality, no less than his vast learning, was a fountain-head of inspiration to the Indian School of Palæobotany". Then follows a brief account of recent work being done on plant fossils from several rock formations in India, arranged in the stratigraphical order, of which the following studies may be noted: "(*i*) "The microflora of some carbonaceous shales from the lower Gondwanas of the Mirzapur District, by Mr. K. R. Mehta (Benares); (*ii*) "The plant remains from the Triassic of the Salt Range", by Mr. R. V. Sitholey (Lucknow), including the first record of a pteridospermous microsporophyll from India; (*iii*) "The microflora of the Andigama (Ceylon) shale", by Miss Janet and Prof. Sahni (Lucknow), the composition of which is strongly in favour of assigning a Jurassic age to the containing beds, as has already been suggested on other grounds; (*iv*) The Cycadeoidea recently collected from the cretaceous beds near Ariyulur, Trichinopoly District, and being described by Dr. K. Jacob and Mr. N. K. N. Iyengar (Calcutta); (*v*) The petrified angiospermic flowers recently collected by Mr. V. B. Shukla (Lucknow) from the Deccan inter-trappean beds near Mohgaon Kalan which have been shown to belong to the same plant, the fruit of which was recently described by Prof. Sahni under the name *Enigmocarpon parijai*; (*vi*) The fossil algæ from (*a*) the Eocene beds of Assam, by Mr. K. S. Rao (Tumkur), containing two new species of *Archæolithothamnium*, and (*b*) The tertiary beds of N.W. Frontier Province, Sind, and Andaman Islands, by Mr. S. R. N. Rao (Bangalore); (*vii*) "The pleistocene flora from the Karewa beds of Kashmir", by Mr. G. S. Puri (Lucknow), which has been so far shown to contain 122 species belonging to 62 genera and 34 families of angiosperms, 6 species belonging to 5 genera of gymnosperms, and some ferns.

Tin Research Report.—In the Tin Research Institute's Report for 1941 it is stated that since Japan began the Far Eastern campaign the main problem has become one of how to make the best use of the supplies available, by curtailing the use of tin in commodities not essential to the war effort, by improving the processes in essential uses, and by recovering tin.

For these tasks, the experience accumulated by the Institute is invaluable, and it has been appointed by the Ministry of Supply to advise on all technical questions affecting the use of tin.

The Institute's hot-tinning plant was in continuous operation throughout the year, and much assistance was rendered to manufacturers in tinning some kinds of steel which have hitherto been difficult to tin.

Collaboration with manufacturers and with Government departments in the application of electro-tinning for parts of armaments was continued during the year, and there has also been considerable interest in electro-tinning for small soldering tags, terminals and clips. It will soon be possible to produce specially thinly coated tinplates, as a war economy measure, requiring only one-third of the tin used on normal tinplate.

Other sections of the Report review the progress made in research on tin-rich bearing alloys, foil and bronzes. Copies may be obtained free of charge from the Tin Research Institute, Fraser Road, Greenford, Middlesex.

Indian Central Jute Committee.—The Annual Report of the Committee for 1941-42 reveals that investigations during the year into the agricultural, technological, marketing and economic problems of jute have now reached an important stage. Noteworthy successes have been achieved in the official jute forecasts through improved sampling survey techniques developed under the technical guidance of Prof. P. C. Mahalanobis. Effective control measures have been evolved for the control of almost all the important insect pests of jute and are awaiting large-scale trials. By organising Grading Parties and Co-operative Jute Sale Societies, the farmers are now being educated in marketing their produces more profitably. The Committee's monthly organ, the Bulletin, containing available important trade and statistical information bearing on jute is getting increasingly popular and is published regularly.

Effect of Storage on Indian Vegetable Oils.—J. S. Aggarwal has made an interesting study of this subject (Industrial and News Edition of the *Journal of the Indian Chemical Society*, 1942, **5**, 121). It is found that although vegetable oils become more oxidised when stored in tin containers than when stored in glass ones, the changes are less than in the case of oils stored in plain steel vessels. However, ghee and tallow showed more oxidation in tinned containers, than in plain steel or glass ones. This may be true for all animal fats, as it has been found that this metal (tin) acts as an effective surface catalyst in the oxidation of lard.

Cork Substitute.—It is reported that cobs (cobs without grain) of the Indian maize (Zeemayes) form a good substitute for the corks if properly finished (L. D. Mahajan, *Science and Culture*, 1942, **8**, 139). These cobs are conical in shape, light in weight, and compressible in structure. The cobs are cut into pieces of desired length, their rough surface smoothed with sand paper and then they are soaked in molten paraffin for a minute or two. Corks so prepared have sufficient resilience as well.

Spark Testing of Steels.—The use of grinding sparks to identify steels is an established method and has been employed in steel mills for a number of years. The equipment required is simple; a portable grinder (a light one), a pair of safety goggles, and a set of

standard steels of known compositions. It is advisable to keep to a single type of wheel, sufficiently hard but soft enough to retain a free cutting face; and with normal pressure exerted on the wheel, its peripheral speed should be approximately 4,000 ft. per minute. Satisfactory results can be obtained with diffused daylight and a fairly uniform background.

L. P. Tarsov (*Iron Age*, 1942, 149, 39-43) has now shown how this art can be extended to classify scrap, and to be practised by less well-trained staff as well. The volume of the spark and the intensity of bursts are very characteristic. Stainless steel sparks are much shorter than those coming from low alloy and carbon steels, while most of the tool and die steels show the characteristic features associated with either a tungsten or high-chromium content material. A useful bibliography is appended.

Rectangular Plywood Containers.—"Owing to the fact that round containers take up much space in storage transit, a rectangular plywood container has been designed by the Forest Research Institute, Dehra Dun. The four sides are made of sheets of ordinary commercial 3-plywood. These are joined together by bent plywood corner pieces; rivets being used for fastening the corner pieces to the side sheets. The top and bottom of the container are of 7-plywood and are fixed in precisely the same way as in the round plywood containers described in Forest Research Institute Leaflet No. 24. All other fittings are the same as in the round containers. The corner pieces are very easily made with the aid of "V"-shaped male and female iron moulds, made from pieces of ordinary angle iron. The moulds are heated over a fire, or on a stove, until they attain a temperature of about 150° F. The veneers are then placed in the moulds (after applying casein cement as for making ordinary plywood), and pressed into shape. It is considered that these containers will be found suitable for greases, powders and solids in sizes upto 60 lbs., and for liquids, oils and paints upto 5 gallons."

Associateship in Sugar Technology.—The following candidates are declared to have passed the final examination for the Associateship of the Imperial Institute of Sugar Technology, (A.I.I.S.T.), held in July 1942. The names are in order of merit.

SECOND DIVISION: (1) Phanindra Bhusan Bhattacharjee, (2) Bimalendu Chakravarty, (3) Shaukat Hussain Ansari, (4) Sushil Kumar Bose.

University of Ceylon.—The first Convocation of the University of Ceylon was held on the 14th October 1942, at the University College, Colombo, with all the customary ceremonial and dignity associated with such events. Besides the Chancellor, H. E. the Governor of Ceylon, and the Vice-Chancellor, Dr. Ivor Jennings, there were seven other distinguished recipients of Honorary Degrees of the University. Two of them were drawn from the Buddhist Order and honoured for their Oriental learning. Two eminent Indians, namely, Sir S. Radhakrishnan, Vice-Chancellor of the Benares Hindu University, and Dr. A. Lakshmanaswamy Mudaliar, Vice-Chancellor of the Madras University, were conferred the Degree of Doctor of Laws (*in absentia*). This gesture of admiration for Indian scholarship must contribute towards fostering a closer cultural relationship between the two neighbouring countries.

Bauxite Deposits in South India.—The presence of important deposits of bauxite in the Shevaroy Hills in South India has been revealed as a result of investigations carried out by the Geological Survey of India following on preliminary work by a local prospector. The numerous analyses made show that the ore is of good quality, containing a high percentage of alumina.

Indian Central Cotton Committee.—There has been an erroneous announcement in the note on the monsoon meeting of the Indian Central Cotton Committee, as published in *Current Science* (September 1942, 11, No. 9, p. 381, left column, para 4, line 5). The pilot plant for production of chemical cotton will be located in the compound of the Technological Laboratory of the Indian Central Cotton Committee, and not in the precincts of the new Bombay University Technological Laboratories.

SEISMOLOGICAL NOTES

During the month of September 1942, two slight earthquake shocks were recorded by the Colaba seismographs as against two slight and eight moderate ones recorded during the same month in 1941. Details for September 1942, are given in the following table:

Date	Intensity of the shock	Time of origin I. S. T.	Epicentral distance from Bombay	Co-ordinates of the epicentre (tentative)	Depth of focus	Remarks
		H. M.	(Miles)		(Miles)	
3	Slight	14 14	1800	..	..	..
24	Slight	10 09	3140	..	..	Epicentral region probably located in the Sulu Sea.

MAGNETIC NOTES

Magnetic conditions during September 1942 were less disturbed than in the previous month. There were 13 *quiet* days, 16 days of *slight* disturbance and one of *moderate* disturbance as against 6 quiet days, 18 days of slight disturbance, 5 of moderate disturbance and one day of very great disturbance during September 1941.

The quietest day during September 1942 was the 28th while the 12th was the day of largest disturbance.

The individual days were classified as shown below.

Quiet days	Disturbed days	
	Slight	Moderate
3-5, 7, 9, 10, 23-26, 28-30	1, 2, 6, 8, 11, 13-22, 27	12

No magnetic storm was recorded during September 1942 while 3 storms, two of moderate intensity and one of very great intensity, were recorded during September 1941.

The mean monthly character figure for September 1942 was 0·60 as against 1·00 for the same month last year.

A. S. CHAUBAL.

ANNOUNCEMENTS

The Government of India have for some time been considering the question of revising the present method of control of imports of drugs and medicines from abroad to ensure that only the most suitable medicines and in the most suitable quantities are imported under the Import Trade Control Scheme. They have now decided to set up for the purpose an Advisory Panel on drugs and medicines with the following terms of reference: "To advise the Government of India as to which drugs and medicines, other than those the formulas of which are included in the official pharmacopœias of the exporting countries, it is essential to import into India from abroad."

(The term 'Official Pharmacopœias' includes the British Pharmacopœia, the British Pharmacopœia Codex, the United States Pharmacopœia, and the National Formulary of the United States of America.)

The Panel will consist of officials and non-officials and will include representatives of the drug trade and industry as well as medical and scientific experts. Its work will largely be conducted by correspondence. Ultimately, however, it will meet at the headquarters of the Government of India when a state of final decision has been reached. The following are the members of the Panel: (1) Brevet Col. Sir R. N. Chopra, C.I.E., I.M.S. (Retd..), Director, Drug Research Laboratory, Jammu and Kashmir State (*Chairman*); (2) Dr. B. N. Ghosh, M.B.E., F.R.F.P. & S. (Glas.), L.M. (Dublin), F.S.M.F. (Bengal), F.R.S. (Edin.), Professor, Carmichael Medical College, Calcutta; (3) Lt.-Col. G. R. McRobert, M.D., C.H.B., D.T.M. & H., I.M.S., Government General Hospital, Madras; (4) Dr. W. R. Aykroyd, M.D., Director, Nutrition Research Laboratories, Coonoor; (5) Sir Hari Shanker Paul, C/o Messrs. B. K. Paul and Co., Ltd., Calcutta; (6) E. B. Fairbrass, Esq., M.P.S., General Manager, Messrs. Keap & Co., Bombay; (7) Dr. B. Mukerjee, D.SC., M.D., F.A.Ph.S., Director, Biochemical Standardisation Laboratories, Calcutta.

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"Science," Vol. 95, Nos. 2473, and 2478.

"Sky," Vol. 1, No. 8.

"Science and Culture," Vol. 8, No. 4.

"Indian Trade Journal," Vol. 146, Nos. 1891-1892; and Vol. 147, No. 1893.

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Lessons in Elementary Analysis. By G. S. Mahajani. (Mr. V. S. Barve, Poona Mathematical Club, Poona), 1942. Pp. viii + 298.

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